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HENNAH'S

COLLODION PROCESS.

Chas. E. Morgan. M.

Photographic Manipulation.

THE

COLLODION PROCESS,

BY

THOMAS H. HENNAH.

FIFTH EDITION.

LONDON:
PUBLISHED BY GEORGE KNIGHT AND CO.,
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PREFACE TO THE FOURTH EDITION.

After the lapse of but a few months the writer of the "Collodion Process" finds, notwithstanding its incompleteness and many faults, that another edition is required. The only alloy to the gratification he derives from so flattering a mark of approbation is, that the small amount of time he can spare will not allow of his making it, as it ought to and could be made, a *complete* manual of the process.

So many suggestions are daily made—most of them, however ingenious, practically useless, and all requiring careful examination before the good can be distinguished from the bad, that the task of selection alone is a long and difficult one, the more so, as in a work professing, as this does, to teach, it is necessary to exclude every thing that is at all doubtful.

Since the publication of the last Edition no improvements worth particular mention have been made in the process; indeed, considering the numbers engaged in the art, and the zeal with which most of them are actuated, its progress is remarkably slow and disappointing, when compared with its rapid strides at first.

The great impediment is the absence of a collodion of uniform character. This has not yet been found, nor from the writer's experience does he see much prospect of improvement, most makers occasionally, some frequently, produce it nearly perfect, but if a second quantity is applied for, it is almost certain to be different; not from want of care, but because no one yet understands all the conditions of uniformity.

All who have the time are earnestly recommended to give their attention to the perfecting of collodion, as the most likely means of rendering this beautiful art not only more popular, but also of extending the range of its usefulness far beyond anything it has yet reached.

If in the next Edition he can state that this bar to its progress is removed, not one of his readers will hail it with more pleasure than will

Their obedient servant,

THOMAS H. HENNAH.

Brighton, December, 1855.

PREFACE TO THE THIRD EDITION.

In offering a new edition of "the Collodion Process," the writer has to express his warmest thanks for the flattering manner in which the previous ones have been received, and at the same time to claim indulgence for the present, in which he fears that, notwithstanding all his efforts to bring it up to the time of publication, a few things may still be wanting.

He has to regret that some things stated in the last Edition were given without proper cautions attached, and so, instead of being beneficial, were hurtful; in others they were wrong. To the first of these proper explanations have now been added, and the last have been rejected altogether.

Much that is new, and it is trusted valuable, is added in the present Edition, and where anything is withheld it is in cases where so little certain is known that error instead of success might be the result of publication.

Thomas H. Hennah.

Brighton, April, 1855.

PREFACE TO THE SECOND EDITION.

THE object of the present little pamphlet is to lay before its readers, in a plain manner, the method of taking pictures by the collodion photographic process; and as to render it really useful in that respect, it is thought necessary to confine attention to one direct course, rather than to offer a pointless summary of all that has been published, no other choice is open than to give the result of personal experience. In doing so fear is entertained that prejudice may so far exert its influence as to cause much that is useful to be passed over; and, what is still more to be feared, much that is useless to have undue weight given to it; still for this the apology must be accepted, that for all that is wrong or wanting, the writer suffers as much as those whom he may mislead, nothing he practises being omitted, and nothing he has reason to condemn being mentioned.

With regard to the means of availing ourselves of the most valuable property possessed by the collodion *negatives* (their power of yielding an unlimited number of prints or proofs fac-similes of each other), a different course has been pursued, such that the writer knows to be good but difficult being omitted, to give place to methods more simple and easy, although it may be not quite so perfect in the end.

It would be ungrateful were the writer to omit offering his warmest thanks to the many kind friends to whom he has been indebted for his photographic knowledge and success, and for the royal road they have made for him by the readiness with which they have given him the benefit of their hard-won experience. When all have done so much it may seem invidious to mention any, still he cannot refrain from again thanking Mr. Berger and Mr. Eden for the many services they have done him, and of which he every day experiences the benefit.

That indulgence will be shown to what is necessarily imperfect, and that those who discover errors will, by pointing them out, enable him to avoid them in future,

Is the earnest hope of their obedient servant,

THOMAS H. HENNAH.

Brighton, July 4, 1854.

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THE

COLLODION PROCESS.

INTRODUCTORY REMARKS.

1. THE great and increasing interest so generally taken in Photography, particularly in the most recent and beautiful process of all, that by Collodion, has induced the author to give a few directions which, as the fruit of long experience, he trusts will enable those who desire to practise this valuable art, to obtain with certainty most beautiful pictures, capable of multiplication to an unlimited extent, and of surpassing delicacy and truth.

2. From the conviction he has for some time felt that most of the difficulties complained of by beginners are of their own making, and owing more to ignorance of the proper method of manipulation to be pursued than to any other cause, he is sanguine that if his directions are as faithfully followed as they are honestly given, they will be the means of helping many to a like success with his own; and while affording a means of useful and fascinating employment, will place at their command an art, the resources of which in aid of the artist, the antiquary, and the naturalist, are as inexhaustible as they are, comparatively speaking, unappreciated.

3. He would not be understood as claiming the merit of originating the whole course of manipulation here given as being most conducive to success; for, from the progressive nature of the subject, he has been obliged to avail himself largely of the labours of others who have bestowed much time and attention upon it; all that he has attempted has been to give in their plainest form, and in good faith, those methods

which a course of careful experiments and successful practice, pursued for some time past, has enabled him to point out as reducing the collodion process to a state of absolute certainty.*

4. Should any one be inclined, however, to find fault with the manner in which apparently trifling details are dwelt upon, he is reminded, that by following and applying the directions given, even those who are novices are almost sure of success, while those who neglect them as unnecessary throw discredit upon their pursuit and upon themselves by their failures.

5. The agent by means of which, from its extreme sensitiveness to light when properly charged with certain of the salts of silver, such beautiful pictures are to be obtained, has not been long known. It is a solution of gun-cotton in a mixture of ether and alcohol; and as all photographers ought to know how to prepare it for themselves, the following methods are subjoined. Before proceeding, however, the writer would premise that the opinions as to the different methods of iodizing, &c., are not hastily expressed, and that every formula has been put to the test of repeated and careful experiment; but still, owing to the uncertainty inseparable from all things with which time, temperature, or manual skill have much to do, it is possible that the same results may not follow the same course of proceeding with any two experimenters, indeed to so great an extent is this the case, that persons accustomed to the sight of photographs can generally distinguish the productions of particular operators by peculiarities of manner, which, considering the simple nature of the process, it seems scarcely possible should be manifested. Forbearance should, therefore, at all times be shown to those who attempt to teach, although it may be unsuccessfully.

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* It is with regret that the writer feels compelled to qualify this statement; there are, however, occasionally instances of failure arising from remote causes, which perplex even experienced operators, and which, while rendering it more interesting, take it out of the domain formerly assigned to it.

PREPARATION OF THE SOLUBLE COTTON.

6. *First Formula.*—Powder, *coarsely*, 8 ounces of pure crystallized nitrate of potash, and after placing it in a basin or broad-mouthed stoppered bottle, add to it three quarters of an ounce (6 drams) of water, and pour upon it ten measured ounces of pure sulphuric acid, sp.g. 1·840, then, when it has been stirred with a glass rod, to ensure perfect mixture, immerse in it, without delay, by the same means, a quarter of an ounce of clean carded cotton, by small portions at a time, taking care that the whole is thoroughly and intimately mixed together. Immediately after which immerse the bottle or pan in a basin of hot water heated to 130° or 140° Fah., so as to keep up the temperature of the mixture. When it has remained at rest from ten to fifteen minutes, remove the cotton, by means of glass rods, into a large vessel of water, and by stirring briskly, and renewing the water repeatedly until it has no perceptible taste, wash out the whole of the acid and every thing soluble; then wring it in a cloth, and, after loosening it by pulling the flocks apart, dry it by hanging it up in a net where it can be exposed to a current of air, which will be found a much better method than by employing artificial heat.

7. The pure acid is recommended on account of its being easily procured of known strength. The object of the addition of water to the nitrate of potash is to reduce the strength of the acid, and at the same time to take advantage of the increase of temperature, which is always caused by the mixture of water with strong sulphuric acid.

8. If red bubbles or fumes of nitric oxide are disengaged in the mixture, as will sometimes be the case when the cotton has been pressed too closely together, it must immediately be stirred with a glass rod, which will generally put a stop to the action. The cotton is not so good when this gas is set free; we should be careful therefore to avoid it as much as possible by seeing

that each addition of cotton is well imbued before more is put in; we should also carefully avoid using too much cotton.

9. If the first water is previously made as hot as the hand can bear, it will act much more thoroughly than if cold; the sulphate of potash formed in the process being but slowly soluble in cold water.

10. The time taken in washing out the acid, &c. (particularly the first wash), influences greatly the solubility of the cotton, and its fitness for photographic use. If it is allowed to remain in either of the first two waters, or if it is dried slowly, it will, in all probability, produce an inferior collodion, and be unequally soluble, while, if the waters are quickly changed, and it is dried rapidly, it should dissolve in a mixture of five parts of ether sp. g. ·720 (washed), and one of alcohol, sp. g. ·8320 (60° over proof) with scarcely any residue; and the collodion should be so tough as to allow of its being rolled off the glass without difficulty, that is to say, before the addition of the iodizing solution. If properly prepared, that is, if the nitrate of potash is pure, the acid of the proper strength, and both well mixed, and the temperature properly maintained, the cotton thoroughly imbued, and afterwards carefully and quickly washed and dried, the film produced by the evaporation of its solution in alcoholized ether should be perfectly equal and transparent in appearance, and quite free from marks, or crape-like lines, even when almost dry.

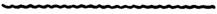
11. To the influence of imperfect and slow washing and drying, the writer believes, is due most of the difference observed between cotton prepared in large and in small quantities. An experimental portion is probably prepared in small quantity, the washing and drying rapidly and thoroughly performed, and the product is quite satisfactory; but upon carrying out the process on a larger scale, this *thorough* operation is not so practicable, and the result is not so good.

12. *Second Formula.*—This, which is a modification of one kindly communicated to the writer by Mr. Williams, is, from

the nature of the materials employed, much more uniform in its product, and (particularly by the amateur) capable of being put in practice with more ease and less risk than the first.

13. Take of pure sulphuric acid, sp.g. 1·840, 6 measures; colourless nitric acid, sp.g. 1·440, 4 measures; fuming red nitric acid,* sp.g. 1·460, 2 measures; and of water, 1 measure. These are to be placed in a broad-mouthed stoppered bottle, and Swedish filtering paper is to be immersed in it, in the proportion of 12 grains to every measured quarter of an ounce of sulphuric acid in the mixture. It is to remain in the mixed acids twenty minutes, and is then to be quickly washed† and dried, as was recommended for the cotton.

14. If this is all carefully done as directed, and no waste is allowed, the paper, when dry, will be found to have increased in weight nearly 75 per cent., to have assumed the crispness and appearance of parchment, and, from being perfectly insoluble, to be as perfectly soluble in the mixture of alcohol and ether.

15. To prevent the paper matting together, and to facilitate the equal action of the acids upon it, it should, previous to immersion, be cut into strips about an inch broad, and then crimped across in this manner 

16. Whichever of these methods is followed, the operation must be conducted either out of doors, or in some place where the acid fumes (which are copiously generated, and are exceedingly injurious if inhaled), can be immediately carried off. The hands, by coming into contact with the mixture, would be stained yellow; glass rods should always therefore be used in moving or stirring the cotton or paper. The smallest quantity falling on to any article of dress would produce a hole in a short time; and even the first two or three waters in which the cotton or paper is washed would stain, and in time destroy,

---

* Frequently called nitrous acid.

† In this case cold water will do.

anything upon which they may be splashed; on this account the whole should be thrown away as soon as it is done with.

17. In making choice of the cotton (or paper), the operator should have in view the particular purpose for which he requires it; that is to say, whether he wishes to keep it on the glass, or transfer the film to paper or wood after receiving the image. If it is to be transferred, cotton *perfectly soluble* should be used, from the facility with which it leaves the glass; but for beginners, or when it is to be kept on the glass, either cotton that is *not entirely soluble*, or paper that is soluble with difficulty, is the best. As far as the writer's experience goes, he believes that in most cases those collodions prepared from *imperfectly soluble* cotton (or paper) become attached to the glass with tenacity, while those in which a perfectly soluble cotton is employed are with more difficulty kept from working up from the glass. The last remark refers more particularly to *cotton* than *paper;* the difference is, however, only in degree. The amount of adhesiveness being materially influenced by the quantity of alcohol present; this may, however, be accepted as a general statement of the difference between soluble and partially soluble preparations.

PREPARATION OF COLLODION.

18. A mixture is to be made of 5 measures of washed ether, and 2 of alcohol, sp.g. ·832, and to each measured ounce of the mixture from 3 to 6 grains of prepared cotton or paper are to be added, shaking the whole together at intervals until a solution is obtained, which, if the cotton is good, will be very quickly.

19. The ether and alcohol must be perfectly pure, and when procured should be kept in stoppered bottles, as from the readiness with which they dissolve oils and resinous bodies (both exceedingly hurtful), they are very likely in the course of manufacture and afterwards, to be rendered unfit for photographic use.

20. Ether that has been kept some time gives a better collodion than when newly prepared, although when iodized it sooner acquires colour from the liberation of iodine.

21. Alcohol of the strength named (sp. g. ·832, or 60° over proof) can be easily procured, but when stronger there is more difficulty.

22. No exact proportion of cotton can be specified on account of the varying solubility of different samples, and also for the reason that a different amount of thickness or viscidity is produced by equal weights of almost every separate preparation.

23. A stock of this plain or uniodized collodion may be prepared sufficient to last three or four months, as it will by standing become clear, and be always ready for immediate use; much beyond this time it will (*if originally fit for photographic use*) not keep good, and those who are unfortunately tempted to lay in a large stock for use abroad, &c., will find themselves sorely disappointed when they attempt to use it. It becomes *short*, and wanting in continuity, producing a granular and poor film, incapable of receiving definition. The writer does not say this from limited experience, he having tried collodion from almost every house in London, which he has had by him for some time, and which in every instance, without exception, he found perfectly useless. He speaks thus plainly, to avoid the loss and disappointment which must be felt severely by those proceeding to a distance, relying upon its remaining uniform, and finding that, perhaps, after a long journey has been taken with a view to its use, the main object is frustrated by its failure, when no means are at hand to replace it.

24. By whichever means the collodion is prepared, it is to be iodized, or made useful in photography, by adding to it the following solution in the proportion of one dram (fluid) to seven of plain collodion :—

Alcohol . . .	sp. g. ·832	1 fluid ounce, [illegible]
Iodide of ammonium .		30 grains.

These are to be mixed together in a stoppered bottle, and, by shaking at intervals, a solution will be obtained, which should be filtered through bibulous paper, and, as an additional precaution against the entry of insoluble matters into the collodion, the bottle in which it is kept should not be disturbed for some time before any is removed for use; in fact, this precaution is most necessary, both with regard to the iodizing solution and the collodion, if very rapid action is required, as it completely prevents the necessity of waiting, after iodizing, for the collodion to become clear previous to use, and so, by enabling us to avail ourselves of the extreme sensitiveness of newly iodized collodion by using it at once, affords us the opportunity of securing many portraits of children and representations of moving objects which could not in any other case be obtained.

25. The sensitiveness of collodion is found, in every instance, to diminish slowly but steadily from the time of its being mixed with the iodizing solution, but although pictures are produced rapidly in proportion to the newness of the collodion, the same perfection of finish and tone is not, with some kinds, so easily reached at first, as when a day or two is allowed to intervene.

26. The influence of this change on the character to the pictures produced is worthy of the closest observation; and as to the novice in photography example may be better than precept, the writer will repeat from a former edition one of the instances which occurred to himself. He took on the same day, as nearly as possible at the same time, two pictures, to one of which he gave two seconds' exposure, to the other forty, and in both cases the results were equally good. Now, the only difference in the preparation of the glasses was, that for the first, collodion only three days old was used, while that used for the second had been mixed more than six weeks. It is necessary to add that both samples of collodion had been prepared in the same manner and from the same chemicals.

27. When the operator is without experience in the working of his collodion, he will save time, temper, and materials, if, in the first instance, he takes two pictures of the same object, giving

to the first, if the light is tolerably good, from one to four seconds' exposure, and to the other from thirty to forty. The difference of their appearance after, and while developing, will be the best guide to the time to be allowed in future trials.

28. Much error has arisen from this fact of the varying sensitiveness of collodion, and the great difference of result according to the length of exposure to light. To these causes the writer attributes the conflicting opinions expressed on the merits of different iodizing and bromizing solutions, and their power of rendering half tones perfectly, the fact being, that by giving a short and a long exposure to the very same collodion, either a perfect absence, or as complete a superabundance of half tone, is obtained in the photograph, and when a comparison has been instituted, in nine cases out of ten, the experimenter has either been led away by novelty, or the iodized collodion has not been quite fresh, while the bromized has, on the contrary, been perfectly so.

29. In this view of the matter the writer is confirmed by many comparative experiments, and from them he is led to believe that, although, perhaps on the score of rapidity of action, the balance slightly inclines to bromized, it still possesses so many defects, that it cannot bear comparison with iodized collodion, and that, for all cases of portraiture or general use, where uniformity of action is desirable, the formula he has given for iodizing is as perfect as any at present known.

30. The difficulty of obtaining good iodide of ammonium experienced formerly, is now no longer a reason for preferring the potassium salt, and although too unstable for the purpose of those who make large quantities of collodion for sale, it is much the more satisfactory to the practical photographer. Its general working is much more equal, and a finer finish can be obtained in the negative than by the means of other salts. Another reason for giving it the preference over the potassium salt is, that when its decomposition is brought about in the

bath, nitrate of ammonia results instead of nitrate of potassa. The reason for preferring the former of which will be mentioned when speaking of the bath.

31. The method proposed by Mr. Crookes for restoring the sensitiveness of old collodion and preserving that of new, by immersing in it a piece of silver foil, is as valuable as it is simple. Collodion becomes slow in action principally from the liberation of free iodine by the decomposition of the iodide of potassium contained in it. Metallic silver combines readily with free iodine when brought into contact with it, forming iodide of silver, which is soluble in a solution of iodide of potassium, and as the object of iodizing collodion is to enable us eventually to form an iodide of silver, it follows that, instead of anything being lost by the combination of the iodine with the silver, our work is in fact anticipated, and that in proportion to the quantity of iodine liberated, combined with silver, and again dissolved by the remaining iodide of potassium, so is the quantity of silver required from the bath to excite the plate diminished. It has lately been suggested that zinc might advantageously be substituted for silver, on account of the iodide of zinc, formed by the action of the iodine in the collodion upon it, being soluble in alcohol, instead of an iodide of silver, which is only soluble so long as there is sufficient unchanged iodide of potassium to dissolve it. Although in theory the foregoing holds good, it does not in practice appear to be of importance which is used, for with neither can old collodion be made to equal new, as is asserted, nor can the relative expense of the two methods be brought in question, the silver costing in the end no more than the zinc, all that is lost in the collodion being, as aforesaid, saved in the bath.

32. Unfortunately, however, these, like many other good remedies, go a little too far. It is necessary to the perfect working of collodion that a minute quantity of free iodine should be present in it, on account of its power of preventing fogging, or cloudiness, and in practice it will be found necessary to add

sufficient tincture of iodine to effect this; generally, for negatives, about a drop to the ounce of collodion will do, or if for positives two or three drops, but it must be remembered that it is only in case of the *complete removal* of the iodine (which may be known by its losing the usual yellow tint), that this addition must be made; at other times it will do more harm than good.

33. A remarkable and almost unaccountable difference is commonly observed in the degree of sensitiveness to light of different samples of collodion independently of the iodizing solution used, and it is believed that more remains to be done in the preparation of a *good collodion*,* irrespective of sensitiving solutions than in any other branch of the process, for there is no doubt that most of the superiority of this over other methods is due to the little understood qualities of the collodion itself. When prepared apparently under the same circumstances, iodized in the same manner, and at the same time, in one instance so much as four times the exposure was required for one than for another; and what is also remarkable, the least sensitive has invariably been that which most slowly showed the colour due to the liberation of iodine. It was for this practical reason that the writer, on a former occasion, did not entirely concur in Mr. Crookes's observations, a proceeding which, he has learned, excited some surprise at the time, although since warranted bv the experiments of others, leading to the conviction that too much stress has been laid upon the benefit to be derived from using collodion free from iodine, when rapidity of action is sought after. It is doubtless of consequence that much should not be present, but the writer believes that to some hitherto hidden cause must be attributed the rapid diminution of sensitiveness observed in collodion after its being first iodized. He has frequently added a large proportion of tincture of iodine to newly-mixed collodion without materially altering its action in any other way than in the production of clearer negatives. It must not, however, be forgotten

* Thomas' Zylo-Iodide Silver 1.6d. the ℥ is said to be the best Negative Col. for sale. Other good ones are Bewley & Evans' (Sackville St. Dublin) & Robinson's (Polytechnic Museum 35 Grafton st. D

when considering these statements, that the condition of the xciting bath may at one time render necessary an alteration in the collodion which at another might be hurtful.

34. It may be expected that something should be said as to the use of iodide and bromide of iron in collodion, but the writer has to confess to a complete failure in all his attempts at making a practical use of them; as, however, many whose names he respects much, have spoken in their favour, he can only attribute to his own carelessness or want of skill the difference of his results from theirs, and must leave to other hands the task of working out their theories.

35. Mr. Shadbolt has added to the list of thoroughly useful and practical suggestions, for which photographers are indebted to him, one for the use of chloroform in collodion for the purpose of making it more sensitive, and at the same time considerably enhancing its power of rendering half tone.

36. It is to be added in the proportion of twenty to thirty minims to each ounce of collodion. In the writer's experience, it has increased the rapidity of his collodion at least one-half, but, except in the case of having a collodion which gives hard and intense negatives, he thinks the above proportion too great, from ten to fifteen being sufficient, the larger dose lowering the intensity so much that the resulting proofs are wanting in vigour and brilliancy.

37. As collodion is the only requisite to the photographer, upon the preparation of which many observations will be made, the writer trusts that he will be excused for the space he has given it, and will proceed at once and more briefly to the consideration of what remains.

CHOICE AND PREPARATION OF THE GLASS.

38. Glass, known in commerce as "patent plate," should be chosen, free from scratches, perfectly even, and well polished, then after having cut it into squares, so as to fit easily into the camera frame, the edges should be roughly ground, in order

that the hands may be protected from injury, and that the adhesion of the film of collodion to the glass may be rendered more perfect than it would be without this precaution; indeed, with some samples of collodion prepared from cotton, it is almost impossible on unground glasses to keep the film perfect through all the washing it has to undergo, the water making its way underneath, disturbing it completely, and of course rendering useless all previous care and trouble (if such a work can be admitted by a photographer).

39. The necessary articles for cleaning the glasses are a few linen cloths (fine diaper is the best material, from its being more free from flue than other kinds), an old piece of cambric and a mixture of tripoli powder with alcohol, of the consistency of cream, to which may be added a small quantity of ammonia, and what may sometimes be found even better, a mixture of cyanide of potassium with tripoli powder, in the proportion of cyanide 1 dram, water 1 ounce, and sufficient tripoli to bring the mixture to the consistency of cream.

40. The cloths should be scrupulously cleansed from all impurities by boiling them in a solution of common kitchen soda, and then washing them several times in clean water, care being taken to avoid the contact of grease at all times. When thus prepared, they should be carefully kept from those used for wiping the frames, &c., and should not be used for any other purpose than those for which they are first appropriated. In fact, as it is upon perfect cleanliness that success so much depends, so it is impossible to carry attention to it too far, if we are desirous of overcoming quickly what might otherwise prove a difficult and tedious task.

41. The best method of cleansing the glasses is the following:—Pour a small quantity of either of the above mixtures upon the glass, and with a tuft of cotton tied up into a ball, or a roll of soft linen rag, rub it well over both sides, then either hold it under a tap or rinse it in a basin of clean water, and before it has had time to dry spontaneously rub it well with

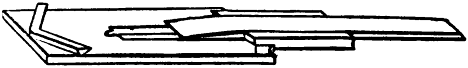
Robinson washes his glasses with a little cyanide on both sides. thoroughly. then rinse with abundant water under a tap. dry with a clean cloth. polish with a bit of cambric & dust with a camel's hair brush.

one of the prepared cloths until all moisture is removed, and finish with a perfectly dry cloth, in which it must be held all the time, so that the hands may not come in contact with it.

42. By breathing occasionally upon the glass, and holding it so that the light may strike it obliquely before the moisture of the breath has quite evaporated, you may readily ascertain if it is sufficiently clean; any streaks or stains can be thus at once perceived, and may be removed by breathing hard so as slightly to moisten the glass and again rubbing it with the dry cloth. When the marks of the breath disappear smoothly and evenly you may be sure that the glass is clean enough; all that is then necessary is, just before coating the plate, to remove, with the piece of cambric, any dust or flue which may be upon it.

43. For small glasses the foregoing method is easily put in practice, but for large ones some precautions must be taken to prevent their being broken by the rubbing they have to undergo.

Fig. 1.



44. The little piece of apparatus represented in fig. 1, the invention of the late Rev. T. Meylor, will be found most convenient as a means of avoiding such an accident. The plate is to be laid upon it, and while one end is held under the bevel at the broad end of the board, the sliding piece of wood is pressed in until the glass is held firmly; to ensure which, the slide is bevelled at the end, and is made to move with sufficient friction to prevent its slipping while the plate is being cleaned. When the operation is finished it is merely necessary to withdraw the sliding tongue, and the glass will be released. The glass may of course be washed and roughly dried before placing it on the polishing board.

45. Additional care is requisite when positives are being worked for, many trifling stains which would not be noticed in a negative being then made very visible. It is therefore better to give the preference to the cyanide mixture in this case, and after drying the glass, to finish with a little dry tripoli and a piece of linen or cambric quite free from grease.

46. After having taken a picture by the pyrogallic process, nothing but clean water is required for cleaning the glasses; but in every other case, notwithstanding what has been said to the contrary, no reliance can be placed upon cleaning with simple water, particularly when the glasses are new. If ammonia is used for cleaning it must not be in the same room in which the plates are rendered sensitive, for if present in the atmosphere and the bath is in a condition to work *well and rapidly*, it is almost sure to cause a blackening of the film when it is developed.

COATING THE PLATE.

47. This operation influencing so materially as it does, by the manner of its performance, the character of the finished picture, is so purely a matter of delicate manipulation, that although very easy in practice to those who have ever seen it done, is, like most things requiring manual skill, much more difficult to teach by precept than example, and although in the following directions the writer has endeavoured to render intelligible to the beginner the method he thinks the best, he would never, theless advise those who have the opportunity to get a little *vivâ voce* instruction from a friend as the best means of saving both time and collodion.

48. Hold the glass horizontally in the left hand by one of its corners, and pour the collodion on to the centre, using a quantity sufficiently great to spread easily over the whole surface, by giving to it a movement of rotation; that is to say, incline the plate, so that the collodion may flow gently

first to corner No. 1, then No. 2, then No. 3 (if possible avoiding the thumb), and then to No. 4. When the surface has been thus perfectly covered, return into the bottle from corner No. 4 all the superfluous collodion, raising the glass steadily, without haste, so that it may be vertical, in a line drawn from 2 to 4, fig. 3; then by raising corner No. 4, cause the lines formed in the collodion by the draining to run into each other, and leave an even surface, after which, return the glass to a horizontal position for a few moments. The principal difficulty in the way of getting a perfectly even film is unnecessary hurry. If the glass is raised quickly to return the excess of collodion into the bottle, it is quite impossible with after care to make it even, and it will be found more economical to sacrifice the small quantity of ether lost by evaporation than to spoil a negative by allowing insufficient time. If a small bottle is used, say a 1 ounce, when plates 5 by 6 are being coated, the deterioration of the collodion by the loss of ether is practically not worth notice, as when it becomes half empty it can be again filled up until it becomes too thick to flow easily, when a small quantity of pure ether may be added to thin it.

Fig. 2.

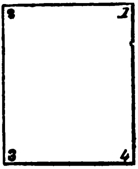
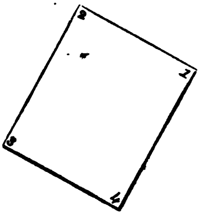


Fig. 3.

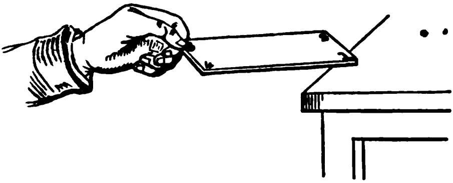


49. Some very experienced operators prefer draining from the opposite corner to that held (No. 1), but there is then the chance of any dirt or impurity upon the finger being carried right across the plate, while by the foregoing method it is retained at the edge.

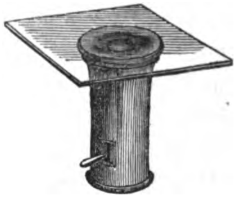
50. When the glasses are so large and heavy as to be difficult to manage without some support in addition to the fingers, they may be easily coated by resting corner No. 1 on the edge of a table or other convenient support in the manner represented in fig. 4.

51. All necessary alterations of position can be made with ease without removing the corner from the table, and it will be found that the directions given above will apply equally whether a support is used or not.

Fig. 4.



52. There are also many different kinds of plate-holders recommended, of which that represented in the accompanying cut is by far the most efficacious.



The plate being laid on the top (A) which is edged and lined with caoutchouc, is secured by pushing the lever (B) into a catch placed lower down, and so causing a partial vacuum. It may be immediately detached by liberating the lever from the catch.

53. A frequent cause of failure is the presence of small pieces of dry collodion on the neck of the bottle; these should be carefully removed, for when suffered to remain they are carried by the collodion on to the plate, and there being partially dissolved cause large *striæ*, which inevitably spoil the picture.

54. Another precaution necessary to be taken when a large quantity of collodion is mixed at a time is, to preserve it in a large bottle and decant into a smaller one, a short time before using it, the quantity required for coating only a small number of plates. By this means the presence of the deposit which sometimes forms at the bottom of the bottle is avoided, and with it the spots upon the picture which it causes. When, however, the care recommended when speaking of the preparation of collodion is taken, that both the iodizing solution and collodion are quite clear before mixing, advantage can be taken of the

R. So too if you do not thoroughly mix your Iodising fluid & Collodion (if yo use Robinson's Col.). by stopping the bottle with your thumb. inverting it & shaking it violently for a few minutes - else there is excess of Iodide in the neck of the flask. undissolved by the Collodion. & this may cause [illegible] extreme sensitiveness of newly iodized collodion, and sufficient only for present requirement need be mixed, there being little chance that this cause of spottiness will be met with.

55. The operator must not immerse the plate in the sensitive bath until the collodion begins to set or become firm. The time to be allowed for this varies, however, so much with the age and make of the collodion and the state of the atmosphere, that no rule can be given as infallible.

56. If the plate is kept too long before immersion, it will be unequally sensitive, those parts which were the most dry being least sensitive.

57. If the plate is immersed too soon, streaks and fringes, or, as photographers call them, curtains, will be observed proceeding from the edge of the plate at which the collodion was least dry. This is the most frequent error, and one more fatal to success than the opposite, but we must be careful in avoiding one mistake that we do not fall into another, but by observation learn the time suited to the collodion in use.

58. All the processes hitherto given may be performed by daylight; but in every subsequent operation, until the picture is fixed, the greatest care should be taken to exclude even the faintest ray of white light except that which acts upon the plate in the camera. The most practicable way of doing this is to cover the windows of the operating room with two or three folds of yellow glazed calico, light passing through a yellow medium having so little (if any) chemical effect that a large supply may be safely admitted, so much at least as to admit of all necessary operations being carried on with ease and comfort. It is a common error, and the cause of many failures and breakages, to suppose that our supply of even this light must be limited to barely enough to allow of our moving about.

59. Should the operator find it necessary to coat the plate by the light of a candle, he must be careful not to approach it too closely when doing so, the vapour of the ether contained in the

To be sure all the apparatus is right – try a plate in it without opening the volet – & see whether or no it can be developed –

collodion being highly inflammable. This caution deserves attention, several instances of severe accidents happening from its neglect having come to the knowledge of the writer.

EXCITING THE PLATE.

60. For this the following solution is required, in quantity proportioned, of course, to the size of the plate and the capacity of the bath :—

Nitrate of silver.	40 grains.	2 ℥
Iodide of silver .	to saturation.	
Alcohol . .	30 minims.	
Distilled water .	1 ounce.	4 ℥

61. These must not be mixed directly together, but the following mode of proceeding must be adopted, which, although for eighteen ounces of solution, can of course be altered by a little calculation to any required quantity, the same proportions being observed :—Dissolve an ounce and a half of nitrate of silver in three ounces of water, and when a solution is obtained, add four grains of iodide of potassium or ammonium previously dissolved in half an ounce of water. This will precipitate iodide of silver,* which will almost immediately dissolve. When the solution has become clear again, add fourteen ounces of water, which will cause it to become opaque from the re-precipitation of the iodide of silver which has been added in excess for the purpose of saturating the solution completely, but which must be removed by filtration through white filtering paper. When the solution has all passed clearly through the paper nine drams of alcohol are to be added.

62. When the alcohol and silver solution has been well mixed by shaking and then allowed to remain at rest for twelve hours, in all probability on exciting a plate with it good negatives will be produced; if such is not the case, it must be

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* The small quantity of nitrate of potash or ammonia produced by this decomposition is of no importance.

Robinson of Dublin's bath is Nit: Arg. ℥j, Aq. dist ℥ij & dissolve perfectly, then having dissolved 5 grs Iod Potas. in about ℥j – ℥iij Aq. dist: add it to bath (so as to give an ex-cess of Iod. Arg. which is dissolved completly by mixing careful.

tested with litmus paper, and if any sign of acidity is shown, ammonia must be poured in, drop by drop, until the acid is neutralized, and a slight alkaline re-action is manifested;* then glacial acetic acid is to be added by two drops at a time, until the plates develope *clearly*. It may, however, happen that, instead of an acid re-action, there may be an alkaline one (see note at foot of page), which will have to be remedied by adding acetic acid as before stated. This latter fault, although much less likely to occur, is much more likely to be perceived by the beginner than the former, for with this he *cannot* get a picture, but with that he can. Neither of them, however, often occur with a new bath, and the remedies, which would do more harm than good if not required, are proposed as remedies only, and not as necessary at all times.

63. The object of neutralizing any acid at first found in the bath is, to avoid the possibility of much nitric acid being present, the writer having frequently experienced its prejudicial effects on the production of negatives, while, on the contrary, acetic acid, when present even in larger quantities, is not so hurtful at all events; while ensuring *clean* negatives, it seems to diminish the sensitiveness of the plate but little, and for working out of doors, or in a strong light, is decidedly advantageous.

64. When, after neutralizing the free acid in the bath, the ammonia is added in *slight excess*, a minute quantity of oxide of silver is thrown down, and this, when acetic acid is added, unites with it, forming acetate of silver, to the presence of which, with free acetic acid in his sensitive bath, the writer formerly attached much value on account of its effectually preventing, by its own decomposition, the presence of even a trace

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* An amount of alkalinity quite sufficient to blacken a plate on developing may be present without exerting any perceptible action on the test paper; it is better, therefore, to try plate by plate after every two drops, until the film, when developed, appears of a transparent reddish brown in cloudy patches, which is a sign that alkali is in excess.

in an India rubber cuvette, it always becomes acid. & then the best way to neutralise it is by using the Ox. silver.

of nitric acid, so long as any remained in the bottle; and, although this opinion is now modified, he still thinks it may be beneficially employed, if not so indispensable as when he entertained a strong opinion against nitric acid even in minute quantity.

65. If the collodion is ordinarily good, negatives produced from a bath composed as above have great intensity, and the deposit forming the lights of the picture is completely in, instead of on, the film, and the negative will, if carefully used, yield many proofs, without being subject to injury, although unvarnished.

66. The addition of a small quantity of nitrate of ammonia is highly advantageous in keeping the surface of the bath and plates clean and free from stains, by its power of holding the oxide of silver in solution, as well as slightly accelerating the action of the bath; but at the same time the bath must always have an acid reaction, or it will itself cause the plates to blacken, the alkalinity, so much talked of lately, being, in many cases (as pointed out by Mr. Hardwich), due to the solution of oxide of silver in that salt rather than to the presence of any of the alkalies simply soluble.

67. The *fogginess* so frequently complained of is, when not owing to light having reached the plate, often caused by the presence of bodies acting as alkalies, the remedy for which (after trying a stronger dose of acetic acid in the developing solution) is the addition of acid (acetic) to the bath, until the alkaline reaction is no longer recognized. The altered developing solution should however always be first tried; many failures of beginners arising from variation in the strength of the acetic acid sold in the shops, much of which is far from its proper strength, while most formulæ for developing solutions are framed on the supposition that really *glacial* acid is to be used. The fogginess is also, though not so often, caused by an excess of *nitric acid*, so diminishing the intensity of the negatives produced, that, in order to obtain any force, the development has to be carried on too long, that is, until a general reduction of silver takes place over the whole surface,

A great cause of spots is not thoroughly cleaning & ventilating during the night the chassis & camera used during the day.

the consequence of which is, that the negative is generally very inferior in quality, and the resulting positives wanting in all freshness and vigour. In this case ammonia must be cautiously added, until the negatives are produced both clean and intense—a drop or two will in most cases suffice; if, however, too much is added, a general blackening will take place.

68. If a bath has been in use some time, and old collodion containing much free iodine been excited in it, a large accumulation of nitric acid, liberated by the union of the iodine with the silver of the bath, will be found in it. This it is which gives rise to the state mentioned in the preceding paragraph, and which must be remedied as there pointed out. Beginners must not be deterred, however, by this statement from using collodion that has been mixed some time, for it is by the use of it in a nearly neutral bath that the best negatives can be most easily obtained, subject only to less rapid action than when a more recent preparation is worked with, and the slight inconvenience of having occasionally to remove the acid produced.

69. The characteristic of negatives produced from a bath containing nitric acid in any quantity is, besides transparency and want of depth, the greenish tint of the deposit when viewed by transmitted light whilst wet.

70. Sometimes a very remarkable and almost contradictory change takes place suddenly in baths that have been simply prepared, that is, without the addition of either acid or ammonia. The image on developing (if the exposure has been of sufficient duration for the production of a good negative, supposing the bath to be in good order) presents the anomalous appearance of an image in some parts positive and in others negative by transmitted light. Those parts which have received most light, such as white drapery, the face, &c., being positive (the reverse of the usual effect), while the parts least illuminated present the ordinary or negative appearance. These effects are accompanied by the disagreeable circumstance that, if we give an exposure sufficiently short to prevent the change in the lighter parts, we cannot get drawing into the darker ones.

A good plan to get dense skyes is to dip the plate after it has been exposed into the Nit: Arg. bath & then develop as usual—; or what is not so good mix the Nit. drippings with

71. It will also be found, by giving considerable excess of exposure, that the whole will become positive, and the problem of obtaining direct a positive image in the camera will be solved. The writer has not yet succeeded in controlling this change so far as to bring it about at will, anxious as he has been to do so; he hopes, however, soon to be able to succeed. At present it remains an useless because an unexplained fact, but although unable to point out the cause, it is satisfactory to be able to point out the remedy, which is no other than repeating that for an acid bath, adding ammonia in the proportion of six drops to sixteen-ounce bath, and taking an experimental plate; if it blackens on developing, sufficient has been added; if not, we must add more cautiously until that result is obtained. Then add acetic acid, drop by drop, until the negatives develope clearly.

72. The most valuable feature observed when this change takes place is, that after the above correction the bath gives more perfect negatives than can be obtained either from a new one or from one which has been treated in the same manner, but which has not previously undergone the change in its properties. After correction we cannot again with any exposure bring about the previous effect of light and shade.

73. Nitrite of silver is a most valuable addition to the sensitive bath in the proportion of from ten to twenty minims of the saturated solution to each ounce of the bath.

74. The preparation used by the writer is not the pure nitrite; it is as follows:—Mix equal parts of nitrate of silver and nitrate of potash, and heat them gradually over a lamp in a porcelain crucible. The mixture will fuse as the temperature is raised; oxygen will be liberated, and the nitrate be converted into nitrite. For photographic purposes the heat must be raised and continued until bubbles of nitric oxide are liberated in small quantity, and a small quantity of silver reduced to the metallic state;* when cold the mass is to be dissolved in as

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* Giving rise, it is conjectured, to the formation of hyponitrate of silver, which, from the photographic effects of hyponitric acid, may be the active agent in producing the change attributed to the nitrite.

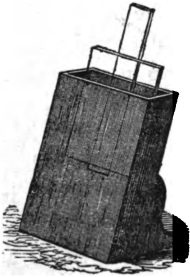
small a quantity as possible of distilled water, and the solution filtered for use.

75. The resulting negatives are very perfect in tone with an amount of exposure, which without it could scarcely be half enough. It, however, entails the necessity in some cases of using rather more acetic acid than usual in developing, to prevent its tendency to produce cloudiness.

76. A general tone of reddish brown pervading and *confusing* both lights and shadows betokens an alkaline bath; but if the alkalinity is only so slight as to be corrected by using more acid in the developing solution, much more beautiful negatives can be obtained than with an acid one.

77. The bath, or rather the vessel for containing it, is best made of gutta percha or porcelain (glass, on account of its transparency, is objectionable), and should be of sufficient width to allow of a large quantity of solution being used; the false economy of using narrow baths being one of the most frequent causes of that inequality and cloudines observed in collodion photographs. For a plate 5 inches by 6 the bath should have at least the following dimensions:—7½ inches deep, 5¾ wide, and 1½ across, and although a larger one is not actually required, still the larger (in moderation) that it is, the more will the equality and smoothness of the picture be promoted.

Fig. 5.



78. The dipper (of which, with the bath, a cut is appended, fig. 5,) should be made of plate glass, a small slip of that material being cemented across the bottom to prevent the plate from falling of. This piece of apparatus should be selected with care, its greatest value arising from the fact, that its smooth plane surface when wetted enables us to bring the power of capillary attraction to our assistance for attaching the plate to it. This will not be the case if an uneven piece of glass is chosen.

79. About double the quantity of solution necessary for filling

the bath should be made, so that by pouring it back into the bottle, after use, it may be able to deposit any particles of collodion, dirt, &c., that may have got into it, and allow of a sufficient quantity being decanted off clear when wanted; this will be found in the end more economical than making barely sufficient to fill the bath, the loss by filtering (which would in that case be unavoidable) not being necessary; it is also of advantage, on the score of uniformity of action, as from its quantity it is not so liable to change as the smaller would be.

80. If the bath has a capacity of 16 ounces, 32 should be made; and if to this a supplementary bottle of solution is added, from which the loss by waste can be supplied, the operator may rely upon uniformity of action for months together. It will be found, that by keeping the larger bottle full (filling it from the smaller), that no addition of silver need be made to keep up the strength of the bath, the loss by conversion into iodide corresponding nearly with the quantity contained in the solution required for filling up.

81. After returning the solution into the bottle the bath should each time be well rinsed with water by half filling it, and then holding the dipper across its mouth so as to close it, shaking it well, repeating the operation two or three times.

82. Sometimes a more thorough cleaning is required, in which case a solution of cyanide of potassium will do it effectually, rinsing it of course afterwards with clean water.

83. It may be as well here to mention, that when the temperature of the operating room is below 60° Fah., the action of the bath is much improved by placing the bottle containing it before a fire, or into a basin of warm water, before using it; this remark applies equally to all the solutions, and to ensure *perfect working*, not only should the solutions be equally heated, but the temperature of the camera as well should be at the same degree, so that the temperature of the plate from first to last may not vary to any great extent.

84. When the collodion, as before mentioned, has slightly set,

the coated glass is to be rested on the dipper, and immersed steadily without any pause, every check given to the movement producing lines which appear painfully distinct on every proof that it yields. The dipper, before placing the glass upon it, should be plunged into the bath for a moment to moisten it, for the reason before pointed out.

85. The proper time for the plate to remain in the bath cannot be stated with precision; it is necessary, as practised by most operators, to allow it to remain undisturbed for about a minute, it may then with advantage be lifted out from time to time to ascertain the state of the film. *When the oily-veined appearance, caused by the ether, gives place to a surface over which the solution flows freely and evenly*, the plate is ready for the camera. No harm is likely to be done by allowing an excess of time in this part of the process as the film is not injured by prolonged immersion when the bath has been prepared with the iodide as before recommended.

86. When the plate is removed from the bath, all excess of liquid should be drained from it, and after doing so it is advisable to wipe the uncoated side of the glass with a piece of clean linen rag, and also to place small pieces of bibulous paper at the corners of the plate frame before inserting the glass, for the purpose of absorbing any liquid that may still drain from it. When thus treated, the plates are much less likely to stain, and the camera can be kept drier and cleaner.

87. When silver corners are added to the frames the blotting paper need not be used, unless indeed we are anxious to keep the camera clean, in which case a piece may be laid along the lower edge of the plate after placing it.

88. In concluding this part of our subject, the reasons for the use of iodide of silver and alcohol in the bath may be given.

89. The iodide of silver is added for the purpose of saturating the bath with that substance, and, by doing so, preventing its attacking and partially re dissolving the coating of the iodide formed on the plate, and so rendering the deposit unequal. If,

however, the plate is kept so long out of the bath as to allow of the solution remaining on it being concentrated by evaporation, it will again acquire the power of dissolving the iodide, and if allowed to get entirely dry, the whole will disappear; we see, therefore, that the protection is only for the time the plate remains in the bath, and does not extend beyond, and that the sooner we use it after it is excited the greater is the probability of its working well.

90. The alcohol is added for the double purpose of making the plate more sensitive (which it does to a considerable extent), and of rendering the action of the bath quicker and more equal. The objection to its use is, that from the different amount of volatility of water and alcohol, the composition of the bath must be constantly subject to variation. The advantages to be derived from its use are, however, so great, that its want of steadiness must be disregarded, and by supplying the waste, by occasionally adding a little fresh, as much as possible remedied.

91. A practicable mode of keeping collodion in a sensitive state for a length of time has been long looked forward to as one of the greatest improvements to which the process is open. For this we are indebted to Mr. Shadbolt; and as his own description is so very clear it is subjoined *verbatim et literatim* :—

92. "Having prepared and excited the collodion in the usual manner, on its removal from the bath of nitrate of silver, it is to be drained pretty closely for about half a minute, and then immersed in a second bath, consisting of distilled water 20 to 30 ozs. to 1 oz. of the exciting bath (the exact quantity is not of great moment), and allowed to remain in the latter mixture until the liquid flows evenly on lifting the plate up, which will happen in about from two to three minutes after immersion. The object of this proceeding is to wash away all but a slight trace of free nitrate of silver, as one of the causes of deterioration of the plate is the crystallization of this salt on the surface of the collodion. This distilled water bath should be in a

vertical vessel similar to that used for exciting, and the same bath, if freed from impurities as they accumulate, will do for an indefinite time. To distinguish it, I shall term it the *washing bath.*

93. "The plate may be removed from this bath as soon as the liquid flows freely, and again drained closely, when a portion of the preservative syrup is to be poured on and off once or twice, being careful to avoid bubbles, or any minute particles of matter being left on the plate, which is then to be stood upright upon *clean* blotting-paper with the collodion side towards the wall, to drain. In about ten minutes' time, the lower edge of the plate where the syrup has become collected, may be touched lightly with fresh blotting-paper to remove the superfluity, and then placed in the dark frame, or stored away in a box for future use. It is not *necessary* to perform *this* operation until convenient.

94. "The preservative syrup is thus made:—Take of *pure honey* and *distilled water* equal parts by measure, mix thoroughly and filter. In my former directions a sixth part of the volume of alcohol was included, but further experience leads me to consider this unnecessary, if not detrimental.

95. "If thoroughly excluded from the action of light, plates thus prepared will keep good for a *very long time.* I have now two small stereoscopic negatives on plates that were excited on the 30th *November last* and not exposed in the camera until the 28th *December*, a space of exactly four weeks. They were not developed until twelve hours after exposure, which part of the process is conducted as follows:—The plate is to be again immersed in the washing bath and left from one to ten minutes to soak, occasionally lifting it up and down to facilitate the removal of the superfluous syrup and thoroughly to soften what remains upon the plate. The longer the latter has been kept, the longer it should be allowed to soak.

96. "When taken out, a sufficient quantity of the developing solution is to be poured over the plate in the ordinary way, and,

provided the plate has been properly soaked in the washing bath, there is no greater difficulty experienced in getting it to flow over, than when a fresh plate is used. The image should appear very slowly, and when all the details are out, *but very faint;* the developing solution is to be returned into the measure (*taking especial care not to allow the small portion remaining on the plate to run in lines*), a feat readily performed if done quickly, and the plate instantly restored to a horizontal position. A small quantity of the *exciting bath* (a 30 grs. solution of nitrate of silver), from an eighth to a sixth of the volume of the solution that was poured from the plate into the measure, together with a like proportion of the preservative syrup, should now be added to the liquid in the measure and well mixed up; this is to be poured on the plate and kept moving until the picture is sufficiently intense, which can be carried to any degree if the exposure has been proportionably prolonged. So intense *can* the high lights be made that a whole day's exposure to *direct sunshine* will not print through them. Of course I only mention this to show what can be effected—not what is desirable.

97. "When sufficiently developed, the picture is washed and fixed as usual, either with hyposulphite of soda or cyanide of potassium as may be preferred.

98. "The developing solution I usually adopt consists of 1 grain to the ounce of water solution of pyrogallic acid, one-fourth of the menstruum being the ordinary acetic acid of the druggists, or, if *glacial* acetic acid is used, one-twelfth part is sufficient."

99. Dr. Mansell's remarks on this process are most valuable, and constitute an addition to it which will extend its application much beyond what Mr. Shadbolt originally anticipated; at all events, Dr. Mansell has, by his improved treatment of the plates before developing, rendered their keeping over extended periods a matter of much greater certainty than before. His remarks are in themselves a pointed instance of the bearing of slight differences of manipulation upon the success of any process which, like all photographic ones, is dependent upon a nice adjustment of a number of trifling and sometimes opposing

influences. All that Dr. Mansell recommends as an improvement on Mr. Shadbolt's plan is to steam the plates before developing; his remarks, however, which are coupled with these recommendations are so good that no apology is offered for adding them at length.

100. "The plates were iodized as usual, immersed in a one-grain nitrate of silver bath for a few seconds, drained, and coated with two doses of syrup. It is much better to be a little prodigal of syrup and make sure work with it, for if it is repeatedly used there is great risk in long excited plates of the reduction of some of the nitrate of silver it contains and consequent speckling of the negative. I (Dr. Mansell) got perfect negatives with plates kept up to 198 hours, but, taking the average of eight experiments, I should say 150 hours is about the limit, after which there is more or less uncertainty. Beyond this time, owing to the hardening of the syrup and its almost total insolubility in the one-grain bath, the negatives were very defective, the image being extremely faint and obscured by a veil of indurated syrup, and the plate mottled over with black patches.

101. "The syrup, after it has been on the plate a short time, consists of two layers, an outer one which remains soft and hygrometric a long time and is soluble in cold water, and an inner film next the collodion, a compound of syrup and nitrate of silver which is insoluble in cold water. This is easily proved by washing the plate in a vertical glass bath, when this layer is seen separating in bran-like scales, the water mechanically removing it. This inner layer, after about 150 hours, becomes adherent to the collodion at first round the margin of the plate, then to the whole surface, covering it as with a varnish, which no amount of washing in cold water will remove.

102. "Seeing, however, that plates kept long beyond the above periods were still sensitive, yielding images, although extremely imperfect, I felt satisfied that, could the indurated syrup be removed, perfect negatives might still be obtained. It occurred to me that steaming the plate would probably dissolve

this indurated syrup, and after a few trials I met with perfect success.

103. "The following is the method I have pursued with plates which had been excited upwards of ten days before exposing in the camera (some having been kept 271 hours), although I am satisfied that the limit to the keeping of plates with this manipulation extends much beyond this period.

104. "On removing the plate from the dark slide, immerse it in the one-grain bath for five minutes, to remove the outer syrup, drain it, then hold it, collodion downwards, over the steam of boiling water poured into a flat pan for about ten minutes, taking care to keep the plate four or five inches from the surface of the water, the indurated syrup will gradually be seen to dissolve, and by inclining the plate the greater part is easily run off to any angle you choose. Having drained the plate, pour on pyrogallic acid (no image appears under this), after a minute or two, when the collodion has been well impregnated, pour off the pyro into a glass containing twenty-five minims of a ten-grain nitrate of silver solution (for an 8½ by 6½ plate), and immediately pour it over the plate, the image rapidly comes out and may be developed as usual to any extent. With some kinds of collodion, or in very cold weather, it may be advisable before using the pyro, either to pour over the plate a weak solution of nitrate of silver, or to mix the nitrate of silver with the pyro in the first instance. I merely suggest this, having as yet found the method I have given quite sufficient.

105. "Steaming the plates cleans them so perfectly and gives such mastery over this method, that it is always better they should be so treated whenever there is the least fear that the syrup is indurated."

106. In this and the following operation it is scarcely possible to avoid staining the hands with the silver solutions. These stains may (if recent) be removed by first washing them over with a saturated solution of iodide of potassium, and then with nitric acid diluted, so as not to stain the hands yellow, that is to say, with twice its quantity of water. The iodide does not itself

mmediately remove the stains, but upon applying the nitric acid they soon disappear.

107. A more expeditious and effectual way is to rub the stains with a lump of cyanide of potassium wetted with water, and as soon as they begin to disappear apply tincture of iodine to them, which will remove them at once, then wash the hands well to remove the cyanide. Care must be taken when using this salt on account of its extremely poisonous nature, and the injurious effects which follow upon its application to any part of the body from which the skin is removed. It must never be used if the hands are scratched or chapped, for in that case it will make its way into the flesh, a troublesome sore will be produced, and the loss of a nail may follow.

EXPOSURE OF THE PLATE.

108. The plate after being rendered sensitive by the last operation is to be submitted to the action of light in the camera with as little delay as possible. The time of exposure necessary for obtaining perfect results varies so constantly with the intensity of light, the power of the lens, and the state of the collodion and the bath, that no rule applicable to all cases can be given; the operator must therefore now depend upon experience as his guide, for *it is only by the behaviour of the film under the action of the developing solution, and the character of the picture after developing*, that he can judge if the exposure has been of the proper duration, and he should as soon as possible make himself acquainted with the appearance of the film both when over and under exposed, so as to be able at once to correct any error he may have been guilty of.

109. When a beginner, if a photographer wishes to produce photographs worthy of being called *pictures*, he should lose no opportunity of learning the causes of the variation in tone and finish observed in the work of different operators, and by finding out the sources of error as well as the means of success, enable himself to produce at will pictures of any character.

110. Difficult as this may at first sight appear, it is not so in

For Stereoscopic views the Collodion should always be thicker than for single pictures – lest it should burn –

reality, and no one should be satisfied until he can command the photographic part of his art. When he can, although he may take a higher position than is deserved by those who have to trust to chance for a picture, he has still much to do before he will gain the name of artist as well as photographer.

111. It is not sufficient to place an object opposite a camera, and regardless of any thing but fine focussing to receive, and, alas! perhaps perpetuate what may be an enormity. Close attention must be paid—whether we are taking a portrait, or view, or copying a work of art—to the selection of a good point of sight, arrangement of light, &c.; and instead of denying or concealing the fact of the distortion of all images of objects in relief when thrown by lenses upon a flat surface, we should always bear it in mind, and by employing lenses of long foci and moderate apertures, and by arranging our subject so as to be as much in one plane as possible, reduce the error to its lowest amount, in fact until it is practically scarcely to be called an error.

112. All this may be and is done by many photographers, and when to this is added an artist's skill in making the most of a subject by arrangement of light and accessories, and choosing the point of sight well, they may surely claim for themselves a better consideration than that to which the mechanical attempts and sorry productions of self-styled photographers had nearly consigned them.

DEVELOPING THE PICTURE.

113. For certainty and uniformity of action nothing has yet been found so generally applicable to this purpose as pyrogallic acid when properly used.

114. The developing solution for ordinary use should be made as follows:—

Pyrogallic acid	1 grain.	R. 3 grs
Glacial acetic acid	5 minims.	ʒi
Alcohol	10 minims.	
Distilled water	1 ounce.	℥iv

Mix, and filter through bibulous paper.

115. This solution will, if kept long, acquire a brown colour, particularly if in a hot place; it will, however, even in summer, remain good for a week, or if made with distilled water that has been recently boiled and kept in a stoppered bottle, it will remain fit for use two or three weeks. A slight degree of colour need not be regarded, still it is better not to mix too much at a time on account of its being undoubtedly rather better if used fresh.

116. The plate, having been removed into the operating room (from which all white light must be excluded) in the camera frame, is to be placed quickly and carefully upon the levelling stand (fig 6). A very convenient form of stand is also shown at fig. 7. A B is a cross formed of two flat pieces of brass, supported underneath by the brass rod (*c*), having a ring at *d*, in the upper part of which is a centre point by which it is supported on the brass arch (G), and kept in a horizontal position by the lead weight (*e*) attached to the lower end of the rod (*c*). F is a flat tray of gutta percha of sufficient size to catch any fluid that may run off the plate. The tray (F) may be supported on the ring of a retort stand, on a tripod stand, or a circular hole made in the table so as to allow the weight (*e*) to pass through. Being then placed on one of these stands, a quantity* of the preceding solution having been measured into a clean glass, a solution of nitrate of silver (forty grains to the ounce of water) is to be added in the proportion of two drops to each dram. When these have been mixed by stirring with a clean glass rod, they are to be poured

Fig. 6.

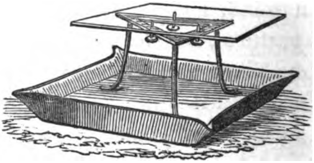
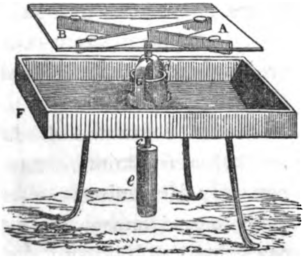


Fig. 7.



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[*] More or less according to the size of the plate.

or almost thrown over the plate, taking care not to disturb the film by moving the hand, holding the measure in a circular manner so as to disperse the contents rapidly and evenly over the surface, which dispersion may be assisted by blowing upon the glass with the mouth; this not only has the effect of rendering the application equal, but serves to keep in suspension the deposit which generally forms, and which if allowed to settle in any one place would spot the picture. The operator should not blow too long in one place, nor with sufficient force to remove the fluid entirely from any part of the plate—cloudy dirty marks being often produced by so doing; another cause of unequal development is neglecting to mix the pyrogallic and silver solutions together with adequate care. *

117. It will be observed that the preceding solution is spoken of as that for ordinary use, and for ordinary and almost universal use it is certainly the best the writer has tried. It may however happen, particularly when a new bath is in use, that it will not give intensity enough even when the collodion and other solutions are in good order. We must then (without exceeding three grains to the ounce) increase the quantity of pyrogallic acid by half a grain at a time until sufficient intensity is gained, at the same time adding a larger quantity of the silver solution.

118. If the wished-for intensity is not procured by the additional strength of the solution, some cause over which it has no influence must be at work, and must be sought for either in the bath, the collodion, or the *time of exposure.*

119. It frequently happens that, instead of a want, there is an excess of intensity; in this case the first step should be to reduce the quantity of, or even entirely omit, the silver solution. If this does not do, the strength of the pyrogallic solution must be diminished; but if neither of these remedies avail, longer exposure must be given. This last certainly prevents excessive intensity and hardness, and is perhaps more needed by the beginner than any other; the common error of allowing too

* If the plate is held on a sucker give a gentle whirling motion to it, that a perfect dispersion of the liquid may be facilitated.

short an exposure, giving rise to the condemnation of many really good collodions, and creating more disappointment than is generally supposed.

120. As soon as the fluid is applied to the glass, the operator should watch the progress of development with the utmost attention, for as before said it is upon a knowledge of the appearance presented by the film of collodion both when under and over exposed, that the beginner will have to depend for ascertaining the time for allowing the plate to be acted on by light.

121. He must from time to time, by holding a piece of white paper beneath the glass, and if practicable, by looking up through it, observe the amount of intensity he has obtained, taking the following remarks for his guide (until he has had experience) as to the time for arresting the action of the developing fluid.

122. If, upon pouring on the solution, the image appears tardily, and the high lights upon the portrait, &c., attain great intensity before the details of the dress are visible, and if after removing the iodide by the hyposulphite it exhibits a greyish appearance by reflected, and a perfectly opaque deposit in the high lights by transmitted light, *it has been under-exposed.* *

123. If, on the contrary, the picture appears quickly, the shadows coming out nearly at the same time with the lighter part, and if after a time it begins to change all over, and, lastly, if upon removing the iodide no picture is visible by reflected, and only a faint one by transmitted light, *it has been over-exposed.* The great want of contrast in over-exposed pictures is worthy of remark, the folds of black and white drapery being even in the same picture scarcely distinguishable by their intensity from each other. It is commonly the case, when a weak solution of pyrogallic acid is used in developing, and the picture is over-exposed, that a beautifully ruby-red colour will be observed on looking through it while wet, and it will be found that, although it appears but of slight intensity, it will yield very perfect positives, the red colour becoming when dry a rich transparent

* hence wash off the liquid before the whites have become opaque -

brown, and by so changing admitting of greater delicacy of tone and definition than when the same amount of intensity is obtained from a more opaque deposit. * On this account it is of more advantage to over than to under-expose, still, from these very terms of *over* and *under*, it will be inferred that there must be some intermediate time of exposure more advantageous than that which would produce either of the results just described.

124. If upon developing, first the lights and immediately afterwards the shadows of the face, followed by the dress of the sitter, make their appearance, the deep shadows under the arms, &c., preserving nearly their original clearness, while the lights go on increasing in power, and after using the hyposulphite * it exhibits a coloured bloom of red and green upon its surface, the principal lines being clearly seen when it is looked down upon, and when looked through all the different parts of the picture are shown in their proper (reversed) gradation of power, a small amount of transparency remaining even in the highest lights, *it has had the right exposure.* Although the characteristics of a properly exposed negative are those given above, a considerable range of time may be allowed without producing an utterly useless picture; but the beginner must remember that it is always better to give too much than too little time.

125. At the risk of repetition, a few useful hints on this subject may be given in conclusion.

126. If a plate has not been much under-exposed, a tolerable picture may often be obtained if the developing fluid is not allowed to remain on long enough to render the lights perfectly opaque.

127. An under-exposed picture is also frequently made useful by varnishing, its intensity being diminished by so doing, while, on the contrary, we should avoid varnishing a weak over-exposed picture for the same reason.

128. If a plate has been over-exposed, it is of very little use

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* This is more particularly the case when nitrite of silver is used in the bath.

* Indeed R. says such an appearance is proof positive that all is well & that the action is very intense. If the skye only is not black enough it may be rendered so by painting it over (after it has been varnished & dry) with a mixture of [illegible] [illegible] black by means of a fine camels hair

collodion will be torn from it; but if *common care* is exercised, this accident is not likely to happen. *

FIXING THE IMAGE.

134. After washing, the plate is to be immersed in a solution made as follows:—

Hyposulphite of soda . .	10 ounces.
Water	20 „

R. 10-20 grs [illegible]
℥j.

Sufficient of this solution is to be placed in a gutta-percha bath similar to that used in exciting; and after resting the plate on a dipper, it is to be plunged in, and allowed to remain until the whole of the iodide is dissolved.

135. The plate may be examined occasionally by lifting it out of the bath, and when it appears quite clean and free from veined markings, it is again to be thoroughly washed to remove every trace of the hyposulphite from it; for if from this being carelessly done any should remain, it will after a time crystallize and destroy the film.

136. It may here be observed that the above solution of hyposulphite will serve for many plates, and must only be renewed when it becomes so saturated with iodide as to require too long a time to complete its action.

137. This application renders the plate insensitive to the action of light, and quickly dissolves the yellow iodide; while doing so the negative picture seems gradually to vanish, and then, if it has been well developed, to reappear as a positive. It is important that the action of the hyposulphite should be continued long enough to dissolve out the whole of the iodide, for if not completely removed at first, it will cause an otherwise good negative to be perfectly useless, the collodion seldom being able to bear a second application of the hyposulphite after it has once dried.

138. The picture, after being drained and then dried by holding it at a short distance from a fire or by placing it in a

* Never retain the solution on the plate after it has attained a dark brown colour

trying to increase the intensity of the picture by continuing the action of the developing fluid long after it has begun to blacken equally.

129. When properly exposed, the action may be continued until the whole of the details are clearly seen by transmitted light, taking care that the lights do not gain too much strength.

130. The operator must not confound the effects of over-exposure with those following upon the action of light upon the film, either from the frame not being well made, or from the room not being sufficiently darkened. They are very difficult to distinguish; in fact, so much so, that experiment is needed by most operators to ascertain to which they may attribute their failure. If the frame fits badly, the cloudiness will generally be partial, while if white light gains an entrance into the room it will be more equal, and will resemble more closely the effect of over-exposure. Light striking into the lens will also produce an appearance resembling over-exposure.

131. In most cases when over-exposed, the whole of the picture appears very quickly, and we see at first that it is the image itself which is developing *altogether* so fast; while if the cloudiness and weakness are owing to the action of extraneous light, the image will appear at first slowly, and then it will seem as if a general deposit took place over the whole surface, veiling the picture completely.

132. The beginner will also find difficulty in distinguishing the effect of an *alkaline bath* from that of over-exposure and from that just mentioned. But, as in the portion relating to the bath, he is cautioned against its use, and recommended to have it at all times slightly acid, time need not be wasted in describing what ought never to be met with.

133. When the development has proceeded far enough, the plate is to be removed from the stand and washed, by pouring a gentle stream of water upon its surface while it is held horizontally. This operation requires care; for if the water is poured from too great a height, or if the plate is too much inclined, the

draught of air, is finished, and may be printed from immediately; it is better, however, when the negative is of sufficient intensity to varnish it previously as a protection from injury.

139. In the event of the operator not being able to procure a supply of pyrogallic acid, he will find the protosulphate of iron a very useful substitute; it is, however, more difficult to obtain good pictures with it: the best method of using it is that proposed by Le Gray.

Protosulphate of iron . . .	500 grains.
Sulphuric acid	20 drops.
Acetic acid	100 minims.
Distilled water	10 ounces.

140. It should be placed in a glass or gutta-percha bath, and may be used for many negatives in succession until its reducing power is so far exhausted that it fails in developing the latent image. The muddy appearance it assumes may be disregarded, no ill effects resulting from it. The plate must be placed on a dipper as in exciting, and must be plunged quickly into the solution. In this there is no difficulty; but in watching the development, much care is required; for if the plate is kept too long out of the bath it will be covered with veined marking, which cannot be got rid of afterwards: it should be lifted out but for an instant, and if it is thought to be sufficiently developed, is to be immediately washed, either by immersion or by a stream of water. If, however, the image is not sufficiently brought out, it must be replaced in the bath until the desired intensity is obtained.

141. Some operators, to increase the intensity of the negatives produced by using the solution of protosulphate of iron, pour over the plate a weak solution of nitrate of silver. This the writer has not tried; he cannot therefore state the necessary strength for the silver solution. In either case, after washing, the negative is to be fixed in the same manner as when pyrogallic is used, the protosulphate of iron recommended by Le Gray for fixing being most uncertain in its action.

Sometimes in taking a group of persons one figure will alone be bad - & on trying a second time that one is good & the rest poor. Now if you take plate No & scratch out the poor figure & put in its place a bit of dark paper; & taking plate 2d similarly remove all but the good figures - you can print plate first - & then print plate second on to the same positive - & thus get all the figures good

142. It must be borne in mind that the iron solution is useful as a substitute, and as a substitute only, for the pyrogallic solution, except when instantaneous pictures are attempted; it may then perhaps be considered superior on account of its doing away with a great deal of the harshness observable in many instantaneous pictures developed with the pyrogallic acid.

143. Many kinds of varnish have been recommended, all of which possess some merit. The writer prefers those made with amber & chloroform: the rapidity with which they dry preventing the annoyance caused by the settlement of particles of dust on those which dry more slowly, and the ease with which they are applied making them also additionally valuable to the beginner.

144. Whatever varnish is used the plate must be perfectly dry before its application, and the drying must not in any case be attempted to be hastened by blowing upon it with the mouth, the moisture of the breath causing an opacity of the film not at all desirable. All the varnishes may be applied to the glass in the same manner as when coating it with collodion, and the above remarks may serve as a caution for all.

145. Mastic varnish (picture varnish) is most frequently at hand, and should be diluted for use with twice its quantity of turpentine.

146. Spirit varnish requires rather different management than do the others. Before its application the plate must be held before a fire until it is as hot as the hand can bear; the varnish is then poured on and drained off again into the bottle, and the glass, particularly if thin, is again to be held before the fire for a few moments, to keep up the heat until the spirit has all evaporated; for when the plate is allowed to cool before the spirit has left it, instead of a hard, bright, glossy surface, only a dull, rough one (similar to that produced by breathing on the chloroform varnish while soft) is obtained.

POSITIVE PICTURES ON GLASS.

147. In touching upon this branch of the subject the writer is

obliged, in some measure, to depart from the course he had intended to pursue, namely, that of giving, instead of a compilation of the numberless methods, both good and bad, that have been suggested, only the one he had been led by experience to adopt; it being his opinion that the beginner at all events will be most benefited by having his attention directed to one course, instead of being bewildered by half a dozen, even if that one should not be the best.

148. As a rule the bath for positives should be more acid than for negatives; it is not however necessary to alter a good bath or to make a new one if *many* positives are not wanted, the effect of an acid bath being easily produced by adding two or three drops of tincture of iodine to each ounce of collodion; by this means almost any collodion will be made to give tolerable positives; although not so good as when a weaker collodion is used, it having been found that for positives a two-grain iodizing solution acts much better than the usual four-grain solution; it is also better to use a rather thinner collodion. The exposure for positives is less than that required for negatives, and they can be obtained with an amount of light which, with any exposure, would be incapable of producing negatives.

149. The chief difference in the course to be pursued for obtaining positives and negatives lies, after exposing, in the development.

150. The method most nearly approaching that for negatives is that suggested in the early days of collodion by Mr. Horne, and is even now thought by many to be good. He merely adds to the ordinary pyrogallic developing solution a small quantity of nitric acid, a drop or even less to the ounce being sufficient; if the picture comes out greenish and wants depth and brilliancy too much acid has been added, if, on the contrary, it looks brown and dull more is required; it must however be remembered that the deposit always looks whiter when dry than when wet. On account of the necessity, in some cases, of using

very small quantities of nitric acid, it should be kept diluted, so that a portion equal to no more than a fiftieth part of a drop of the strong acid may, when required, be added.

151. It will, with most kinds of collodion, be necessary to add to the developing solution some nitrate of silver, in the same proportion as recommended for negatives.

152. They may be fixed in the same manner as negatives, but more care must be taken to wash away all the developing solution before immersing the plate in the hypo, otherwise the acid contained in it will decompose the hyposulphite, and cause a blackening of the deposit, which, although not very injurious to negatives, would entirely spoil a positive. The cyanide fixing solution, given on the following page, is at present preferred by most operators to the hyposulphite; it certainly gives a whiter picture, although, in the opinion of the writer, not so rich a one.

153. The brilliancy and finish lost by drying when positives are obtained, either by this or any other means, are always restored by varnishing.

154. Far more brilliant, although to many not such pleasing, positives can easily be obtained by the following method:—Collodion rather thinner than usual is employed, and the plate is excited with the usual bath, and after exposing, not more than half the time that would be required for a negative, the image is brought out by immersing it in a bath made as follows:—

Protosulphate of iron	40 grains.
Nitric acid	2 drops.
Acetic acid	30 minims.
Alcohol	20 minims.
Distilled water	1 ounce. *

The iron is to be dissolved in half the water, and when a solution is obtained, the nitric and acetic acids are to be diluted by mixing with the remainder, and are to be added to the iron solution; the alcohol may then be added.

* Such also is R's process —

155. No injurious effect arises from this solution becoming thick, as it does after being used two or three times; it is better however to filter it occasionally, and when not in use to preserve it from the air in a stoppered bottle.

156. In this, as in most other cases where positives are worked for, they may be fixed in the same manner as negatives.

157. The following method of M. Martin is much praised by French operators, and by many who have tried it here. Instead of the usual bath, one composed as follows is employed:—

Nitrate of silver	40 grains.
Nitric acid	24 minims.
Distilled water	1 ounce.

158. After exposure the plate is developed by immersion in a bath of sulphate of iron, which, instead of M. Martin's formula, had, the writer thinks, better be the same as that recommended in the preceding paragraph. When sufficiently developed he washes it thoroughly with water, and then immerses in another bath composed of—

Nitrate of silver	12 grains.
Cyanide of potassium . . .	77 grains.
Distilled water	7 ounces.

which will convert the negative picture into a positive of a whiter and better colour than when hyposulphite is used.

159. It will often, in developing positives, be found that if sufficient exposure has not been given the picture developes slowly. When this is the case, instead of the blacks being pure and strong, a formation of small spangles of metallic silver takes place, after a time, over the whole picture, and of course spoils it. On the contrary, when over-exposed, the developing fluid acts so rapidly on the parts that have received most light, that it has to be poured off before the half tones appear; in this case the blacks will be very strong and clear, but all definition will be lost in the lighter parts.

160. The development must not be carried nearly so far as

when bringing out negatives; it should be stopped before the details are visible in the darker parts, on account of the colour of the deposit forming the picture approaching so nearly to that of the iodide already there, that until the unchanged portions are removed we cannot perceive all the detail in the shadows that may have been obtained.

161. Contrary to the fault of under-developing, so frequently committed when working for negatives, it is more frequently found that good positives are spoilt by going too far, and that if we had not been so anxious to see all, we should not have lost all, the effect of over-developing being to blend into one mass the light parts of the image to the extinction of most of the delicacy for which positives are prized. In concluding this branch of the subject, the writer would caution those following his directions that he does not by any means think himself qualified to say much on positives on glass, but little of his attention having been given to them. He is also aware that there are methods much more perfect than those with which he is acquainted, but on which as a professional photographer he finds great difficulty in procuring information, particularly on a subject of such increasing value to those who possess any secrets of their own; and unfortunately there are few of sufficient liberality to make public all they know.

PRINTING OR TRANSFERRING TO PAPER.

162. As without some instructions for making use of them, the negatives, towards the production of which so much attention has been directed, would be of no value, the writer has to offer from the many formulæ that have been proposed a selection of those most likely to be generally useful; he would at the same time wish it to be understood that, in preference to those capable of giving brilliant results, but at the expense of much time and labour, he has chosen those which from their simplicity are most likely to be serviceable to the beginner, leaving to the more

practised operator the task of working out the improvements he may think necessary.

163. There is a marked difference between papers manufactured in England and on the Continent, most of those made abroad having a large portion of starch in their composition, and from that circumstance affording black colours readily,*while in the English papers the starch is generally replaced by gelatine, and the black colours can only be obtained with difficulty. In many papers there is also a large quantity of chloride, which affects materially the results to be obtained upon them. One description made by Nash contains so much, that with no other preparation than brushing over a fifty-grain ammonio-nitrate of silver solution, very beautiful proofs are to be obtained. There is also a foreign paper which contains a larger quantity, at all events sufficient to render an alteration in the strength of the solutions necessary.

164. The apparatus required need be neither complicated nor expensive, all that is actually necessary being comprised in the following list:—

165. A few pieces of stout plate-glass rather larger than the pictures they are to be used in in printing,—some plain, others having smooth black cloth evenly pasted over one of their surfaces.

166. Some drawing boards, on which to pin the paper when the solutions are applied by brushing.

167. Some flat dishes for applying the solutions, when floating is preferred to brushing.

168. Two or three brushes made expressly for photographic purposes.

169. Some dishes for washing the proofs after fixing them.

170. Bibulous paper.

171. When a sheet of paper has been rendered sensitive by either of the following means, it is to be laid, the prepared side up, on one of the covered glasses; the collodion negative is to be carefully placed, the coated side downwards, upon it, and then upon

* The paper should have a smooth surface, a firm & even texture, weigh from 12 to 24 lbs. per ream, of equal transparency throughout, free from spots of any kind. not too strongly sized — a starch-sized being preferable to a gelatine-sized paper, as chemically pure as possible, free from any water-mark, & old paper should be selected in preference to new. The best paper is that of Canson Frères, Turner, Whatman & Lacroix. The quality is ascertained by examining it vertically before a light, & the side chosen is that without [illegible]

that one of the plain pieces of plate-glass, the weight of which will be sufficient to bring the negative into close contact with the paper. After having done this in a moderately dark room, remove it to where the light of the sun, or even diffused daylight, can have free access to it for a time, varying with the intensity of the negative and the light, until it is dark enough. It may safely be looked at, by first carefully taking off the upper glass, and then while one end of the negative is pressed firmly on to the paper to prevent it slipping, the other is lifted just high enough to allow the progress of the picture to be seen. If it is not dark enough, the glass must be lowered down, and it must be again exposed to light.

172. Some difficulty may be found at first in returning the glass to precisely the same place it before occupied on the paper; a little practice will, however, soon enable the operator to do it successfully; and as so much of the beauty of the proof depends upon its having the proper amount of light, he must frequently inspect its progress: he will therefore do well to master this piece of manipulation as soon as possible.

173. The proof should always remain in the light until it is considerably darker than it is desired to be when finished, to allow for the loss it always sustains in the hyposulphite bath, and it should be borne in mind that an under-printed picture cannot be improved, while one that is too dark can, by prolonging the action of the hyposulphite, be reduced to almost any extent.

174. There are several ways of applying the solution to the paper; those most generally practised being either by the brush, or by floating the paper on a quantity of the solution placed in a flat dish.

175. When only small quantities of paper are wanted, it will generally be most advisable to apply the solutions by brushing, it being the most economical method. It will also be found that if a quantity of a solution is prepared, it will by brushing yield uniform results so long as any remains, while if applied by floating,

a constant change goes on; so that when a comparison is made between the first and last sheets prepared, it will scarcely be possible to believe that the same process has been followed.

176. The use of the brush has been much condemned; not, as the writer believes, from its being really difficult or wrong, but from the unnecessary cautions which have accompanied directions which have been given for preparing sensitive paper by its means. The paper to be prepared should be pinned by its corners to a smooth drawing-board, having previously placed a piece of white blotting-paper somewhat larger beneath it to absorb any solution that may pass over the edge. The solution is then to be brushed freely over it, first in one direction and then in the other, crossing the strokes so as to ensure an equal coating, repeating the operation if any inequality is observed. Sufficient of the solution should be applied by brushing in the first direction, the subsequent crossing being for the purpose of rendering that equal. Very little practice will enable the operator to apply just so much that by crossing once or twice there shall be no patches unabsorbed. When free from running moisture, the paper is to be pinned up by a corner to dry.

177. It is not necessary to have the paper perfectly dry before applying the silver solution, more brilliant proofs being obtained by its being brushed on while slightly damp. After the silver solution is on, however, the quicker and more perfectly it is dried the better.

178. The operator must not be deterred by this caution from laying by a stock of salted or half-prepared paper, if so inclined, the difference being very slight; still, as there is a difference, it is thought right to mention it.

179. For floating the paper, a much larger quantity of the solutions will be required. They must be poured into a flat dish to the depth of about a quarter of an inch, and then the paper, previously cut to the proper size, is to be floated, by first placing one end on the fluid, while the corners of the other end are held by the fingers, bringing the whole gradually down upon it, and

exercising sufficient pressure to prevent any air-bubbles from remaining. When the ends cease to curl up (generally after one or two minutes), it is to be slowly raised, and then pinned by a corner to the edge of a shelf or table; and to facilitate the draining, a small piece of bibulous paper is to be attached to the corner from which the liquid drops. It is to remain suspended until dry.

180. One of the best formulæ for use with the brush is the following :—

1st sol.	Hydrochlorate of ammonia .	5 grains.
	Distilled water	1 ounce.
	Iodide of potassium . . .	½ grain.

This solution may be applied at any time, no harm resulting from the paper being kept.

181. 2nd sol.—A fifty-grain solution of ammonio-nitrate of silver, which may be made as follows :—Dissolve 50 grains of nitrate of silver in about three quarters of an ounce of distilled water, and when perfectly dissolved add, drop by drop, a solution of ammonia; this will at first cause it to become turbid, but by cautiously continuing the addition, it will again become clear. No more ammonia than is just sufficient to redissolve the precipitate should be added, and, to be certain that no excess is present, a few drops of a fresh fifty-grain solution of nitrate of silver are to be added, to render it again very slightly turbid. The whole should then be poured into a glass measure, and distilled water added to make up a measured ounce.

182. If there is any excess of ammonia, no care will enable one to obtain an even coating by brushing, the traces of the brush where last passed over coming out distinctly in printing. If, however, the correction is carried much too far, the print, although quite even, will be indifferent, and have an effect of colour in some cases very remarkable, the lighter parts of the picture coming out when finished of a greenish tone, while the shadows are brown. This is more generally the case when small

quantities of chloride are used; with the proportion above given it is very seldom seen.

183. This solution is to be brushed on in the same manner and quantity as the first solution of hydrochlorate of ammonia; and as soon as it is sufficiently dry to allow of its being hung up, it is either to be pinned to the edge of a shelf in a dark room, or, which is much better, thoroughly dried at a fire. The paper will not keep long after the application of the second solution; for, even if secluded from light and air, it will in the course of two or three days discolour.

184. If with this formula French (starch) papers are used the colour of the finished proofs will be of a black tone; but with the English (gelatine) papers, the colour will be a rich brown.

185. The use of ammonio-nitrate of silver has been, without reason, much attacked of late, on account of the supposed want of permanency of proofs procured by its means. This the writer ventures to think is an error, most of the blame it has been visited with being due either to the small quantity of chloride formerly recommended to be used with it, to the use of old and acid baths of hyposulphite, or, which is quite as frequent, the carelessness of operators themselves in washing out the solutions imperfectly; and he thinks if a comparison is instituted between proofs obtained by the same operator by this and any other process, it will be found that the defective ones will be equally distributed among them, the balance being perhaps in favour of albumen; not, however, from its giving really more permanent proofs, but that from the nature of its surface it repels moisture better than the others, and so is less open to injury.

186. Another good formula for use with the brush is the following:—

1st sol.	Chloride of ammonium .	8 grains.
	Iodide of potassium . . .	½ grain.
	Distilled water	1 ounce.
2nd sol.	Nitrate of silver . . .	80 grains.
	Distilled water	1 ounce.

N. B.—Paper prepared by this formula will keep much longer than by the last.

187. For floating, it is necessary to have a larger proportion of chloride than for brushing. The following answers well:

1st sol.	Chloride of ammonium	20 grains.
	Iodide of potassium	½ grain.
	Distilled water	1 ounce.
2nd sol.	Nitrate of silver	90 grains.
	Distilled water	1 ounce.

188. The same time should be allowed for floating, both on the chloride and on the silver, a longer time to either being equivalent to a larger dose. If the proofs when finished are too brown, a shorter time on the silver or a longer on the chloride will produce a blacker tint.

189. There remains now only to mention albumenized paper, which, as affording positives of high finish with but little experience, has met with much favour. One of the many formulæ for its application that have been recommended is the following:

190. Take any quantity of the whites of eggs, and add to it an equal bulk of distilled water, then to the mixture add hydrochlorate of ammonia in the proportion of 16 grains, and iodide of potassium in the proportion of half a grain to each measured ounce. The whole is then to be well beaten with a silver fork, or, what is much better, placed in a porcelain egg-beater and well shaken. By allowing it to remain at rest for twelve hours, all the fibrous portions will sink to the bottom, and the limpid upper portion can be decanted off for use. It may be applied by floating; not more than one minute, if the operator is practised from a quarter to half a minute; the shorter the time the better. The papers best suited for albumenizing are the thin French and German. English kinds have not answered in the writer's hands.

191 When dry, the paper should be ironed with a moderately-

Robinson recommends highly the albumenised paper of Spencer to be had at Gaudin 26 Skinner St. London or Rue de la Perle, Paris.

hot iron, previously placing it between two sheets of clean, smooth paper, and should then be laid by in a dry place: it will keep for any length of time.

192. When required for use it may be made sensitive by floating it for two or three minutes on the following solution :—

Nitrate of silver . .	50 grains.	120 grs
Glacial acetic acid .	2 minims.	
Distilled water . .	1 ounce.	℥j

Protected from light it keeps for one week after its preparation.

FIXING THE PROOFS.

193. To fix the proofs which may be obtained by either of the foregoing methods except the last, the following solution can be used.

Dissolve in a bottle—

Hyposulphite of soda	1 ounce.
Filtered water . .	5 ounces.

194. In another bottle dissolve 15 grains of nitrate of silver in half an ounce of distilled water; and when dissolved pour it into the solution of hyposulphite; shake the two together, and let the mixture stand twenty-four hours before using.

195. The proofs should be carefully immersed in this bath, and be allowed to remain not less than an hour. If, however, they should have been so much over-printed as to require reducing still more, they may remain a longer time. After removal from this bath, they should be immersed for about ten minutes in a fresh solution of hyposulphite of the same strength as that just recommended, but without the nitrate; they may be then well washed in a dish of hot water five or six times, draining them well between each, and allowing them to remain in the two last a quarter of an hour or more; they may then either be pinned up or hung over glass rods to dry, and should afterwards be smoothed with as hot an iron as can be used without scorching.

R. says that the Hyp. sol. if warm gives far the richest tones. He first puts the positive in a fresh saturated solution of hyposulphite & allows it to remain there until the creamy film (which you see on examining for an instant in the light the proof when just taken out of the press) has

196. By the process of Le Gray, in which blackened chloride of silver is used in the proportion of seventy grains to each ounce of hyposulphite in solution, very beautiful proofs of a neutral tint can be easily obtained; but if we wish for the additional security afforded by washing with hot water, we must sacrifice much of this beauty and be content with dull brown colours.

197. For the albumenized paper (and if desired for all the others), the following fixing solution may be employed:—

Hyposulphite of soda	. 1 ounce.	℥j
Distilled water . .	. 5 ounces.	℥vj
chloride gold		2 grs -

198. When the hyposulphite is dissolved, add two grains of chloride of gold previously dissolved in half an ounce of water; this will probably cause a precipitation of a small quantity of sulphur, which will have to be removed by filtering through bibulous paper. When clear, the solution will be ready for use. The proofs must be watched, and should be removed when the desired colour is obtained. They will at first become brown, but will gradually get blacker and blacker until they attain a rich purple. The change with a new solution goes on rapidly, two or three hours sufficing for the black colours, but after a time as much as even twenty-four hours will be needed, still they *can* be reached by giving time so long as the hypo has any solvent power left.

199. The proofs must be well washed as before recommended, and if hot water is preferred it may with more safety be used.

200. Although breaking through the writer's intention of mentioning only those methods of easy application, he cannot pass over Le Gray's very beautiful process for obtaining purple and black colours; but at the same time he would caution those who attempt its practice that, although perfect in the hands of those who have had experience, it is of all photographic processes one of the most difficult to manage successfully.

201. Paper prepared with plain nitrate of silver is better for this purpose than the ammonio-nitrate. The prints should be exposed much longer than for the ordinary method of fixing, in

disappeared - then place : in an old solution of hyposul-phite to which is added a solution of chloride Gold (15 grs to the Quart of water) until the chocolate [illegible] become black metallic - the whites very brillant. Next wash it thoroughly in several changes of [illegible] fact until the whitish parts are of a violet hue. After the proof has been so exposed, it is to be immersed in the following solution, taking care to move it about while in:—

Distilled water	2 ounces.
Chloride of gold	1 grain.
Pure hydrochloric acid . .	10 minims.

202. The picture clears immediately after immersion, becoming altogether lighter. When nearly light enough, it is to be washed in several waters to remove the acid, and then immersed in a bath of hyposulphite of the strength of one ounce of the hyposulphite to six of water, in which it is to remain not less than half an hour; it is then to be washed and dried as usual.

203. Very good results are to be obtained by reversing the application of these solutions; that is to say, by first over-printing the proof, then fixing in the hyposulphite, and then, after washings, immersing in the acid bath of gold, and again washing. Perhaps the last is the most secure of all methods of fixing.

204. The process for printing enlarged copies from small negatives is so interesting, and of so much value, that a short notice respecting it may be of service, particularly as the writer is not aware of any method having been published by which good proofs can be obtained.

205. A hole rather larger than the size of the negative should be cut in the shutter of a darkened room, into which a sheet of waxed paper or ground glass is to be inserted, and if a slide is made to fit an ordinary camera of long focus, so as to receive the negatives and allow of light passing through them, we have all the apparatus necessary.

206. The negative fitted in the groove at the back of the camera must be brought within a few inches of the ground glass in the shutter, and, to prevent the diffusion of light in the room, a black cloth should be thrown over the space between the negative and the ground glass.

207. An ordinary double-portrait lens answers well, in fact, with

the middle of the back - so as to enable you to reverse the sides without having to use the stereoscope - paste on to the card & polish it. To obtain a skye which shall deepen in tint from the horizon upwards you do viz- Take the positive out of the chassis & exposing it to the light you trail several times a piece of paper from the horizon upwards - then plunge the positive into the fixing solution -

the exception of the slide for the negatives, the camera and lens remain as generally used, the image being thrown from the negative through the camera and lens on to a screen. With it portraits of any size may be obtained from the same negative, subject only to the range of the camera and the size and distance of the screen and paper.

208. Turner's "Patent Talbotype" paper is to be immersed, twelve sheets at a time, in a solution of iodide of potassium of the strength of three grains to the ounce of distilled water, and after half-an-hour's immersion is to be hung up to dry. It will keep for several months.

209. The following solution is required for exciting:—

Nitrate of silver	15 grains.
Acetic acid	15 minims.
Water	1 ounce.

210. Just before use, immerse completely in this solution one of the sheets of iodized paper, and allow it to remain ten minutes, then take it out, and without blotting lay it on a sheet of glass perfectly clean, and place it on the screen (which should have wooden buttons to secure it) and by placing a piece of yellow glass in front of the lens the image may be focussed upon it direct; when perfectly sharp and distinct, the removal of the yellow glass will allow the light to act.

211. The time of exposure of course depends upon the amount of light, but with a bright sun shining upon the ground glass, and with a good lens, ten minutes will generally suffice.

212. The image should be slightly visible before developing, to do which (to develope) remove the paper from the glass and immerse it in a saturated solution of gallic acid, adding for a twelve-inch picture, half-a-dram of the exciting solution. When sufficiently developed, immerse in common water and wash several times, then fix by immersing in a solution of hyposulphite of soda, of the strength of one ounce to four of water, until the yellow iodide is entirely removed, and wash again thoroughly

You can also make a small neg. from a positive - & then enlarge it as above - You do not have to reverse at all single - but you do double lens pictures or they will not be stereoscopic -

in several waters, allowing it to soak in the last two or three hours.

213. When dry it will be finished.

214. We have now, from the first preparation of the glass to the final fixing of the proof, gone, it is hoped with sufficient care, through what is called the Collodion process; and if, in his attempt, the writer should have succeeded at all in removing the obstacles which unavoidably accompany the study of an art involving chemical changes of great delicacy, he will have the satisfaction of thinking, that the time he has given to Photography has been better bestowed than if his own amusement or profit had been the sole result.

WEIGHTS AND MEASURES EMPLOYED.

215. In almost every instance the quantity of solid substances has been mentioned as so many grains, but where the ounce or dram is mentioned, the ounce of 480 grains and the dram of 60 grains are to be understood.

216. When fluids are mentioned the *measured* ounce is meant, and the ounce is divided into eight drams of sixty minims each.

SOLUTIONS REQUIRED FOR NEGATIVES.

217. Sensitive bath—

Nitrate of silver	40 grains.
Alcohol 60°	30 minims.
Distilled water	1 ounce.

Iodide of silver to saturation.

These must not be mixed direct, but the directions given in the body of the work must be followed.

218. Developing solution—

Pyrogallic acid	1 grain.
Acetic acid	5 minims.
Alcohol	10 minims.
Distilled water	1 ounce.

219. Silver solution for developing—

Nitrate of silver	40 grains.
Distilled water	1 ounce.

220. Fixing solution—

Hyposulphate of soda . . .	10 ounces,
Filtered water	20 ounces.

221. In the different formulæ given it is supposed that all the chemicals are *pure*, the acetic acid *glacial* (solid at 40°), the nitrate of silver crystallized, the alcohol free from all extraneous matters, and the water, except where otherwise mentioned, distilled.

222. Those who are desirous of making Collodion for themselves, or in fact of making any exact experiments, should learn the use of the specific gravity bottle, it being impossible without it to be sure that we can repeat any experiment successfully; very few chemical liquids being sold of known or uniform strength, although they may be pure in so far that they are free from anything but water, still upon the quantity of that may depend the success of an experiment which has occupied much time.

The specific gravity bottle is made of very thin glass, having a perforated stopper, and capable, when filled and the stopper inserted, of holding exactly 500 grains of distilled water at 60° Fah.

These bottles are sold with a counterpoise of the exact weight of the empty bottle, so that when it is filled with water and placed in one scale of the balance and the counterpoise in the other, 500 grains will be required to bring it into equilibrium. All that we have to do, therefore, with any liquid, the specific gravity of which we are desirous of ascertaining—such as ether, alcohol, or sulphuric acid,—is to fill the bottle and insert the stopper, when any excess will come up through the hole and must be wiped off. When perfectly dry it is to be weighed, and whatever the weight may be required to balance it, such as for washed ether 360 grains, or sulphuric acid 920 grains, by multiplying by 2 we get the specific gravity as compared with water, or 1000; for instance, ether, sp.g. ·720; sulphuric acid, sp.g. 1·840. In the case of these two liquids dilution would be detected in opposite ways, the ether would be heavier, the acid lighter.

223. In weighing solids it is a good precaution to cut two squares of writing-paper to put into the scales from the same piece of exactly the same size; this is easily accomplished by folding a piece and cutting them together from it with a pair of scissors. If this is done for everything we weigh, there is little fear that anything wrong will get into our solutions, as we can by procuring chemicals from respectable houses be almost sure of their purity, more so than of the strength of the fluids required.

224. Care should be taken that all measures are quite clean and dry, and that the bottoms are also clean.

225. The smallest trace of hyposulphite on the camera frames or in the developing solutions will cause the plates to be stained.

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WEIGHTS AND MEASURES.

TROY WEIGHT.

Pound	℔.	12 ounces.
Ounce	℥	8 drachms.
Drachm	ʒ	3 scruples.
Scruple	℈	20 grains.
Grain	gr	1 grain.

480.0 grains Troy	1 ounce Troy.
437.5 ,,	1 ,, Avoirdupois.
7000.0 ,,	1 ℔. Avoirdupois.
5760.0 ,,	1 ℔. Troy.

ENGLISH MEASURES.

Gallon, *Congius*	8 pints.
Pint, *Octarius*	20 fluid ounces.
Fluid Ounce, *f.* ℥	8 fluid drachms.
Fluid Drachms, *f.* ʒ	60 minims.
Minim, *m.*	1 minim.

FRENCH WEIGHTS AND MEASURES.

	English Grains.
The Gramme	15.4340
,, Decigramme	1.5434
,, Centigramme	0.1543
,, Milligramme	0.0154

The Kilogramme equals nearly 2lbs. 3 oz. 4½ drachms Avoirdupois.

The Litre is equal to about 1¾ pint imperial, (*i.e.*) 35 oz.

INTRODUCTION.

It is proposed, in the present little treatise, to give plain instructions in that branch of the photographic art known as the "Collodion Process;" and it fortunately happens, that while this process is capable of producing more beautiful results than any other, the required manipulations are of a character so simple and easy, that with an ordinary amount of care, attention, and patience, the amateur must meet with success. We ask for his care and attention to our instructions, and hopefully promise on our part, that his patience shall not be tested too severely by theories, technicalities, or other mysteries of photography.

The photographic pupil should begin at the general, and then proceed to the particular; thus, he should gain a superficial knowledge of the principal causes and effects involved in the process, and afterwards carefully follow the manipulatory details. We purpose assisting him in this proceeding, by a slight sketch of the art, before practical instructions are laid before him.

We will not rake up our Greek to show that all pictures produced by the agency of light are properly named "Photographs;" the term, however, is commonly applied to finished light-drawn pictures on paper; those on silver plates are called "Daguerreotypes," and those on glass and collodion, "Xylotypes," or "Glass Positives."

Photography is strictly an artistic application of chemistry, and the photographer soon becomes—to a greater or smaller extent—a practical chemist. Nitrate of silver is the first chemical which comes under his notice, and it is the most important of all the compounds which he uses; a strong solution of this salt brushed over a piece of white paper and dried in the dark, assumes, when exposed to sunlight, a grey, and finally a brown colour; and if any opaque substance be placed on a part of the paper during the time of exposure, it will be observed that, such part being protected from the action of the light, a photographic outline copy of the opaque substance will be obtained. Now the principle involved in this fact,—the reduction or decomposition of the nitrate of silver,—regulates and determines the action of nearly all the various photographic processes: thus, in the collodion process, a fine kind of transparent paper is formed on a plate of glass, by pouring on it an ethereal solution of gun cotton and iodine (termed iodized collodion): the ether evaporates and leaves a thin film on the glass, which is plunged into a vessel containing a solution of nitrate of silver; the nitrate immediately produces a surface similar to, but more sensitive than, that of the prepared paper first spoken of; the sensitive film, still adhering to the glass plate, is then placed in the focus of a camera obscura, and an image or shadow of some object thrown on its surface; the light reflected from this object rapidly causes a surprising but invisible change,—the image in the camera has impressed itself on the sensitive surface of the collodion film, but the impression being latent requires development, and this is effected by pouring a chemical solution over the surface of the impressed film; the image very soon makes its appearance, and only requires to be "fixed," or secured from the further action of the light, when the photograph is finished. A picture thus produced, when held over a dark object, and seen in the ordinary manner by reflected light, has its lights and shadows properly disposed, and is a perfect copy, save in colour, of the image formed in the camera obscura; but when viewed as a transparency, the lights and shadows are reversed: supposing that a portrait of a gentleman had been taken, the collodion photograph, seen by reflected light, would show a white shirt-front and a black coat, this would be a "positive" photograph; but the same glass held up to transmitted light, would present the appearance of a black or opaque shirt-front and a white or transparent coat, this would be a "negative." In practice it is found, that the best negative by transmitted light, makes the worst positive by reflected light, and *vice versâ;* a slight difference, therefore, is required in the treatment of the sensitive plates, the principle remaining the same.

Supposing that the process just epitomized have produced a perfect positive, it has black varnish or velvet placed on one side of the glass, and its slight negative character destroyed; on the other hand, if the picture be negative, its value lies not in itself, as is the case with a positive, but in its power of producing an unlimited number of positives on paper; this by a process called "printing." Paper is prepared in the dark with chloride and nitrate of silver, and, when dry, the negative is placed on a sheet of the sensitive paper, fixed in a glazed frame, and then exposed to daylight, which passing easily through the most transparent parts of the negative, blackens those portions of the paper immediately under them, and forms the shades of the photograph, while the lights are preserved by the opaque parts of the negative; when properly printed, the paper photograph is taken from the printing-frame and fixed, by removing the unaltered and now unnecessary chemicals from the surface of the paper. The process can be repeated on other papers with the same negative, until a sufficient number of prints is obtained.

Having briefly glanced at the collodion processes in all their simplicity, in order that the tyro may be in some way prepared for what is to follow, we pass at once more deeply into details, premising, that in aiming at excellence the operator must strictly follow the instructions, omitting nothing because he may think it unnecessary, or because the reason for it is not very apparent; he may rest assured that our desire to simplify the process has not permitted us to set down any thing which we are not certain is absolutely necessary to success.

COLLODION PROCESSES.

PREPARATORY ARRANGEMENTS.

It is the fashion, and a good one too, for the ambitious of photographic honours, to purchase complete sets of apparatus; much trouble and expense is spared by this proceeding, as all unnecessary apparatus and badly-matched tools are avoided. We can imagine the rather anxious receipt of the neat box with its "complete set;" the contents are admiringly overhauled, and there is, mingled with just the faintest suspicion of failure, a strong feeling of hope for the photographic future; but here, just at the onset, a difficulty presents itself,—"What shall I do first?"

Begin by preparing a temporary dark room; this may easily be made from an ordinary lumber-room or bed-room: supposing the latter, and that it have but one window, have a double black calico blind made, rather larger than the window, and furnished with a few loops along the hems, to fasten to corresponding hooks round the window frame: at the lower end of the black blind, a piece measuring about two feet square should be cut out, and its place supplied with three thicknesses of bright yellow calico; on fastening the blind over the window and closing the door, the room should not admit a gleam of light, excepting that proceeding through the yellow calico; the edges of the blind require especial attention, as a very slight pucker, which would admit a few rays of daylight, would be fatal to all collodion operations; the yellow calico will give an ample supply of light to enable the operator to see what he is about, and will not have the slightest injurious effect on any of his most sensitive preparations; a large table to work on, a smaller one for delicate apparatus or preparations, and a good supply of clean water, will complete the arrangements, and on the first bright day a commencement may be made.

According to the convenience of the amateur, this arrangement for a dark room may be modified or entirely altered; the essential part is freedom from daylight when the plates or papers are in a sensitive state: candle-light is objectionable, unless the flame be screened by yellow glass or calico.

We should recommend the amateur to make his first essays on paper by copying leaves, lace, and engravings, on chloride of silver in the copying-frame, as detailed in the section on "printing;" the advantage is in the simplicity of the process, and the manner in which it prepares the photographer for more difficult operations; it also makes him familiar with the action of several important agents in his art: still we do not insist on printing being his first step; let him secure a friend for a sitter, and, if he please, at once perpetrate a portrait. In any case, it will first be necessary to prepare the chemical solutions required for the process in which the essay is to be made; an account of these solutions, with the manner of preparing them, if introduced in this place, would, by their complication, tend rather to confuse than instruct; they have, therefore, been arranged by themselves at the end of the Pamphlet, and can be referred to as required.

POSITIVES ON GLASS.

PREPARATION OF THE GLASSES.

CHOOSE from the stock of glass plates those which are free from scratches, specks, and other flaws, and which fit properly into the various sized frames; let these glasses have the edges ground or roughened with a coarse file, or the stick of composition made for the purpose, and which is easily procurable; the glasses may then be well washed with common water and dried with a clean cloth.

Make a thick paste, by mixing together about equal quantities of liquid ammonia, tripoli powder, and spirits of wine, and then reduce it to the consistency of cream by the addition of water. Supposing that a dozen glasses are to be cleaned, after the first rough wash, take a small piece of rag or cotton wool, dip it into the tripoli mixture and well rub it over both sides of the glasses, which are then placed on a shelf and leaning against the wall; when the last plate is done, begin again with the first one, which is now coated with dry tripoli. With one of the clean linen cloths, kept specially for this purpose, rub off the tripoli and well polish the first glass, and then proceed with the others; they are now half-cleaned, and can be kept in a box until required for use; the last polish is given just before using; one side is again carefully rubbed all over with the tripoli mixture and immediately wiped off with a soft clean cloth, then the surface is polished with a clean silk handkerchief—whose legitimate occupation is gone,—or with a large and clean wash-leather. From the commencement of cleaning the glass, the fingers must avoid touching the surface—it can be held in the hand (itself clean and dry) by its opposite edges, until the final polishing is to be given, when it can be fastened in a plate-holder or laid flat on a clean piece of paper and finished; breathe over the polished glass, and observe if the breath settle on it and evaporate evenly; if it do, the glass may be considered as properly cleaned, and with one more polish, when free from the moisture, can be used immediately; but if, when breathed on, the glass show any streaks or irregular marks, the polishing must be repeated until such streaks and stains disappear; it is almost impossible to use too much care in this matter, as a good picture cannot, by any chance, be made on a glass which is not chemically clean.

COATING THE PLATE.

At this stage of the process there are required a tall narrow bottle, containing the positive iodized collodion, an oblong gutta percha vessel, nearly filled with the positive nitrate of silver bath, and a slip of glass, called a dipper. The manner in which the collodion and the silver bath are made, will be found with the directions for the manufacture of the various solutions used in the processes.*

The upright gutta percha trough is improved by being provided with a loose-fitting cover, which can be made out of gutta percha, or cardboard and brown paper; it serves to keep out both light and dust, and allows one to let daylight into the dark room while the plate is being made sensitive in it,—a proceeding sometimes necessary, but generally dangerous. The dipper should project about an inch above the bath, when placed in it, so that it can be easily felt in the obscure light, and also be a support to the cover.

Clear from the neck of the collodion bottle any dried pieces of collodion which may be attached to it, and holding one corner of the polished glass by the thumb and first finger of the left hand, pour on the centre of its cleanest side rather more than a sufficient quantity of the iodized collodion to cover its surface; then slightly incline the plate, that the thick fluid may flow evenly over it from corner to corner, and the superfluous collodion be returned to the bottle from the corner last covered. It is desirous that the film formed on the glass by the evaporation of the ether, should be perfectly clear and structureless, and in order to produce this it is necessary to coat the plate carefully, and with the "knack" which a little practice will soon afford. Never let the collodion run twice in one direction, but let it flow steadily and without jerking or hurry, and in pouring back the superfluous quantity into the bottle, bring the glass gradually from its horizontal to a vertical position, allowing the corner nearest to the bottle to rest on its neck and dip down into it: when the collodion begins to drip slowly, oblique lines will form on the plate, but by slightly altering its inclination the lines will coalesce and disappear. It is as well to run the collodion round the thumb without coming in contact with it, as the mere trace of any foreign substance washed from it, and mixed with the collodion on the plate, would certainly cause blemishes to appear when the picture came to be developed. We have said that the collodion film should be formed without hurry; still it is advisable not to waste too much time over it; a plate can be very deliberately coated in from ten to twenty seconds.

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* See Solutions for Glass Positives, p. 57.

Before the plate is made sensitive, the film is allowed to "set;" the ether and alcohol in the collodion very rapidly evaporate, and in a short time would leave the film perfectly dry and unfit for use; on the other hand, if the plate were immersed before the film had properly set or partially dried, the collodion would be decomposed, and stains and other nameless phenomena would develop themselves.

The time required for the setting of the film varies with the temperature; in very hot weather the plate can hardly be immersed in the silver bath too soon after coating; in winter, from a minute and a half to two minutes may be allowed; probably the average is about half a minute.

MAKING THE PLATE SENSITIVE.

In following the preceding directions for cleaning and coating the glasses, one corner of the black blind may be looped up and daylight freely admitted into the dark room; but before another step is taken, every ray of white light must be excluded. When the collodion film has set, draw the glass dipper nearly out of the nitrate of silver bath, and place the plate on it with its coated side outward and its lower edge resting on the cross piece cemented to the end of the dipper; then, taking the upper part in the hand, steadily, but rapidly, immerse the dipper, with the supported glass, in the silver bath, and put on the cover. As the plate has to remain for several minutes in the bath, the time can be well employed in arranging the sitter, if a portrait have to be taken; this being done, as described further on, return to the dark room, and closing the door, draw the dipper cautiously up, that the excited plate may not fall off, and by the yellow light carefully, but quickly, note the appearance of the film, and then return it to the bath; it will be observed that it has lost its great transparency, is of a yellowish white colour, and comparatively opaque; this is the result of a chemical action exerted by the components of the silver bath and the iodized collodion; the iodide of potassium in the collodion is a colourless soluble salt, but immediately it comes in contact with the nitrate of silver solution, it is decomposed; so also is the nitrate of silver to the extent of the decomposition of the iodide of potassium, an exchange of parts is effected,—nitrate of potash formed in the bath and iodide of silver in the collodion film. Iodide of silver is a pale yellow, insoluble powder, and its formation and presence in the film are very clearly indicated by the colour and opacity which it produces. The non-chemical reader may desire to know why this mutual decomposition occurs; we must refer him to any elementary work on chemistry, where he will learn that under certain circumstances, very many similar interchanges and decompositions of compound bodies take place, and that such changes are governed by the "law of affinity:" it will be sufficient for him at present to know that he has a result of this law before him—a film of collodion containing iodide of silver, and covered or wetted with a solution of nitrate of silver.

In addition to the change in the constitution of the film, there is another circumstance which requires especial attention before the plate is used: it will be found that after one or two minutes' immersion in the bath, on drawing up the plate, the fluid will not run evenly over it, but will flow in streaks, and the film appear oily, but after a longer soaking the long waving streaks vanish, and the solution runs evenly over the plate: until this appearance is seen, the plate must on no account be used; the effect can be facilitated by drawing the plate up and down in the bath three or four times. The time that the plate should remain in the bath is dependent on the state of the film and the temperature of the room: perhaps four minutes is the minimum time allowed, but a longer time, say to the extent of a quarter of an hour or more, is seldom hurtful; on the contrary, the sensitiveness is improved by it,—the only drawback is in the fact, that minute holes or specks are very frequently found in the film after long soaking in the silver bath.

EXPOSURE OF THE PLATE.

Place the camera on a suitable stand, and point the tube containing the lenses in the direction of the sitter; a reduced and inverted portrait will then appear, more or less distinctly, on the ground-glass at the back of the camera, and the miniature will become larger or smaller as the distance between the camera and the sitter is diminished or increased; with every variation of the distance, a corresponding adjustment of the camera and its lenses is required, in order to produce on the ground-glass an image perfectly sharp and distinct; this is effected by drawing out or pushing in the inner box of the camera, so as to alter the distance between the lenses and the ground-glass; when the image is tolerably clear, then by turning the pinion attached to the brass tube, a very accurate adjustment of the focus can be obtained.

In focussing, use a dark cloth, sufficiently large to cover the back of the camera, and to draw over the head and shoulders; with the eyes thus protected from external light, a very distinct image of the sitter can readily be focussed on the ground-glass.

Return to the dark room, draw up the plate from the silver bath, and observe if the solution run evenly over the film: if it do not, move it up and down in the bath as before directed. When the oily appearance is gone from the plate, remove it from the dipper, and let the excess of silver solution drain from one corner into the bath; then place it in one of the camera slides, previously fitted with the proper sized frame, for the glass just prepared. The uncoated side of the glass should be outward, and facing the door of the dark slide; on closing this door the spring attached to it presses against the back of the prepared glass and keeps it firmly in its place. A cursory examination of the ground-glass and the dark slide will show that the surface of the prepared plate, when placed in the latter and fitted in the camera, will be situated exactly in the same place that the rough side of the glass occupied when the image was focussed; consequently all that is now required is to draw out the frame carrying the focussing-glass, and to substitute the slide which holds the sensitive plate. Place the brass cap over the lenses and draw up the sliding door in the dark frame, then —having requested of the sitter as amiable an expression as is consistent with perfect immobility—remove the brass cap. It is quite plain that an image of the sitter is immediately thrown on the surface of the collodion film, and in a very short time the desired but invisible effect is produced. The time of exposure in the camera varies with the power of the light, the dress and complexion of the sitter, and the sizes and focal length of the lenses; it is, therefore, quite impossible to give any reliable rule on this point, without being acquainted with every circumstance. The positive process being an exceedingly quick one, amateurs are very apt to over-expose the plates; it would be well then to commence by giving a short exposure, say from one to four seconds on a bright day, and to correct by further trials the failures caused by under exposure; these are easily distinguished in the development.

When it is judged that the plate has been sufficiently exposed, replace the cap on the lens-tube, slowly push down the sliding door of the frame, and remove it at once to the dark room for development. There should be no unnecessary delay between exposing and developing the plate, as the wet film soon gets partially dry, and gives rise to patches and transparent spots on the picture; the same effect is produced if any considerable time elapse between exciting and exposing the plate.

DEVELOPING THE PICTURE.

On returning to the dark room, place near the yellow light, and rather beneath it, a pan or large basin to catch the waste chemicals and water which are going to be used; on the right of this, have ready to hand a bottle holding the positive developing solution,* a small glass measure or other lipped vessel, recently cleaned, another bottle containing the fixing solution, and a jug holding a quart or more of clean water.

Put a little of the developing solution into the glass measure—for a plate 4 inches by 3 about half-an-ounce will be sufficient. Remove the exposed plate from the dark slide, and holding the glass by one corner in the left hand and over the waste pan, pour on the film a sufficient quantity of the developing solution to cover it, but not run over. It should spread over the surface without stoppages and run to the edges very quickly, or indelible stains will shortly appear. Do not throw on the developing violently and in one place, but pour it on in a stream near the upper edge of the plate, moving the hand at the same time, so that having begun pouring at one corner, the plate may be filled when the hand has reached another. By these means the spreading of the solution is facilitated and an ugly blot avoided —the latter inevitable when the developing is thrown forcibly on one spot.

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* See Positive Developing Solution, p. 58.

The film being covered, a faint outline of a figure soon appears, which rapidly grows more intense, and gradually the details are brought out. The greatest attention is required at this stage, as a good picture can be so readily spoiled by over or under development; it is against the former that the amateur must especially be upon his guard. The best plan is not to develop for the shadows, but to look well after the lights; first the whitest objects appear, such as a shirt-front or collar, then the face and hands, the rest of the plate remaining yellowish and unaltered; directly the detail in the shadow-side of the face appears, stop the developing action, by pouring over the plate plenty of clean water and thoroughly washing away (into the pan) every trace of the developing solution. Now hold the plate up to the yellow light and observe the appearance of the picture; the face and hands should show most of the detail, but very lightly marked, and the densest parts have but little opacity; the darkest shadows should not be made out at all, but present the yellow colour of the unchanged iodide of silver. If the plate be well washed, daylight will not have any further action on the film, and the blind may again be looped up and the picture fixed.

An under-exposed positive is known by the slow action of the developing solution; the whites come out very strongly, but the half-tones are invisible; by continuing the development for some time, more detail is gained, but the transparency of the shadows is sacrificed—they become covered with a brownish and speckled deposit, and the picture is spoiled.

An over-exposed plate has the image formed on it immediately that the developing solution is poured on; the picture shows at once all the detail, but is flat and weak, and further development does not tend to strengthen it.

FIXING THE PICTURE.

STILL holding the plate horizontally by one corner, pour the fixing solution* quickly over it, in the same manner, and with the same precautions, that the developing solution was used. The yellow, unaltered iodide of silver in the film is very rapidly dissolved away, while the opaque parts remain unchanged. Directly the last trace of the yellow iodide disappears, wash off the fixing from the film with plenty of clean water, at least a quart for the smallest plate, and a quantity proportionate to the larger sizes. It is very necessary not to spare the water, as a small quantity of the cyanide left on the plate would soon eat away the picture; for the same reason it is essential that the fixing should be washed away immediately on the disappearance of the yellow opacity in the shadows; on delaying the rinsing, the cyanide gradually clears off the delicate shadows—the charm of all good photographs—and soon reduces the picture to a patchy daub.

In washing the plate—both before and after fixing—some little attention is required to the manner of doing it, otherwise the film will be apt to split from the glass and ruin the picture; the stream should be sent in different directions, shifting the position of the plate as the water is poured on, and taking care that it does not get under the edges of the collodion.

After washing the picture, which is now quite unalterable by the strongest light, place it over a black cloth and examine its appearance; the blacks should show the cloth through, undimmed by the slightest cloudiness or opacity, and the whites should be clear, deep, and have their gradations of tone fully preserved; if otherwise, there is a fault somewhere, and further trials must be made.

Neglect in any stage of the collodion processes almost invariably leads to failure, but the most careful sometimes arrive at the same goal: we have, therefore, drawn up a list of the most common cases of failure, and arranged them in columns, one the effect and the other the cause—the latter leading, it is hoped, to the remedy. Still, not to break the natural order of the process, we will first finish the portrait just supposed to have been taken, and which we are willing to believe is a great success.

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* See Positive Fixing Solution, p. 58.

FINISHING THE PICTURE.

After washing, the plate should be placed on a clean shelf, free from dust, the film turned to the wall, and the upper edge of the glass resting on it; in an hour or two it will be dry. If time be an object, the glass can be gently heated over a spirit lamp or before a fire, until the film is free from moisture; it can then be varnished, if it be thought necessary. Amber varnish may be poured over the film and allowed to soak in for a few seconds, and the excess returned to the bottle, taking care that the lines or channels of the varnish run into each other and dry evenly. A good deal of practice is generally required to do this well, and, after all, the varnishing is of doubtful advantage.

The picture now requires "backing up:" pour on the plain side of the glass some black varnish, and tilt it gradually from corner to corner until the plate is nearly covered, minding that the sable fluid does not run over the edge and on the face of the picture, to do which the varnish seems to have a perverse inclination; now lean the plate against a wall to dry, which is done in an hour or less, and the photograph is finished. It can be readily tinted, by stippling on dry colours with soft brushes, and using moist colour for the high lights and any small effective touches.

The picture thus finished is reversed, as regards position; that which was to the right hand of the sitter will appear to the left in the picture ; in fact, just as we see ourselves in a looking-glass. If this be objectionable, the black varnish can be spread over the collodion side of the glass, instead of on the plain side ; but as it is apt to crack, and by other means destroy the picture, even when used over the transparent varnish, it is a plan which cannot be recommended. Some photographers use black velvet for backing up their positives, and it possesses many advantages ; a piece can be cut of the same size as the plate, and placed in contact with either side ; it is then mounted under glass, to secure it from the action of damp air, and the picture is complete.

FAILURES WITH GLASS POSITIVES.

THE APPEARANCE OF THE PICTURE.	THE CAUSE.
1. The plate has one or more large curved marks (apparently between the film and the glass), or has a cloudy, mottled appearance, which shows very plainly in the transparent shadows.	1. The glass was imperfectly cleaned ; the cause of the circular smears is known by their following the direction of the hand in polishing the plate.
2. Very small transparent spots are spread, more or less thickly, all over the plate.	2. Either left too long in the silver bath, or too long in the dark frame, before or after exposure.
3. Transparent spots of different sizes, fewer in number than in the last case, and not regularly spread.	3. Dust or other impurities in the collodion or silver bath ; particles of sawdust from the camera or its slides sometimes fly on the plates, and prevent the light acting on the film beneath.

4. Clear daubs, of half-an-inch or longer, running in one direction over the plate.	4. Never jerk down the slide of the dark frame; it generally splashes the drainings of the plate over the film.
5. One black patch (transparent), most likely circular in form.	5. The developing solution poured on with force and in one spot.
6. The plate has eccentric markings, something like comets, with specks at the heads and with tails of various lengths.	6. The collodion used too soon after mixing; the small particles sometimes seen on iodizing the collodion have not had time, some to re-dissolve, and others to settle to the bottom of the bottle.
7. One or more fine lines running nearly straight across the plate.	7. The plate immersed in the bath, not with a continuous motion, but stoppages made—every stoppage causing a line.
8. The corners of the plate have opaque stains; perhaps the edges also.	8. A dirty slide and the plate not well drained. The corners of the slide can be varnished with advantage, or blotting paper placed between the edges of the glass and the supporting corners.
9. Irregular stains over the surface of the film—not proceeding from a dirty glass.	9. Most probably the developing solution was not spread over the surface quickly, and thus its action was unequal.
10. The picture is free from stains or other similar blemishes; the blacks are clear, but the whites are flat, and the shadows too heavy.	10. Under-exposed or under-developed — most likely the former.

11. Similar to the last case, with the lights nearly bright enough, but the deepest shadows heavy and speckled all over.	11. Under-exposed and over-developed.
12. The lights flat and without detail, and the shadows wanting depth.	12. Over-exposed, over-developed, or both together.
13. A large film all over the picture—destroying all contrasts.	13. If not greatly over-exposed, there is daylight in the dark room; the slide or camera also may not be light-tight.
14. There is a greenish blue tinge either on a part or all over the plate.	14. The developing solution not well washed from the plate previous to the application of the fixing solution; or bad collodion.

NEGATIVE PROCESS.

ALTHOUGH the process about to be described is very similar, as regards manipulation, to that adopted for the production of positives, yet, the results being of so different a character, it will be necessary to show where the difference exists, and to add certain directions respecting the silver bath, the development, &c., tending to simplify and make certain the process under notice. It must be borne in mind that no time or trouble can be misspent in making a good negative, as all its excellences or imperfections are transferred to every paper copy printed from it.

THE NEGATIVE COLLODION.

THE glass being cleaned as described in the positive process, coated with negative collodion, and immersed in the negative silver bath, has now to be exposed. The conditions which regulate the proper exposure are continually varying, and to a much greater extent with negatives than with positives: the collodion being more highly charged with iodine, more readily decomposes, and this decomposition greatly influences its sensibility. Collodion within two hours after its being iodized, is highly sensitive, and it is possible, on a sunny day, to take very satisfactory instantaneous pictures by using it; on the other hand, by using iodized collodion a month old, an amount of exposure would be required from five to ten times longer than that for another sample recently mixed. It might be supposed that the great sensibility of new collodion would be of advantage in every instance, but it is not so; it should be used only in such cases where the amount of light reflected from the object is small, or where the exposure must of necessity be short, as with copies of old paintings or bronzes, and portraits of children. Old iodized collodion is indispensable for taking satisfactory copies of light engravings and for views; the reason for this is found in the fact, that the newer the iodized collodion, the greater the liability of the picture to contract, with other defects, a certain mistiness, called "fogging,"—the film is so extremely sensitive that, with a strong light or bright object, the diffused and reflected light in the camera act all over the plate, and thus the purity of the deep shadows is destroyed; with old collodion this cause of fogging—one of several—never occurs. With the knowledge of the varying sensibility of the collodion, the operator has the power of choosing that most suitable for his purpose; he should keep the plain collodion and the iodizing solution in separate bottles, and mix them as required, with reference to the age at which he intends to use the negative collodion,—within a few hours for quick portraits or copies of very dark objects, from twelve hours to a week old for ordinary work or portraits, and from three weeks to two months old for sunlit views and copies of very bright objects, where the lengthened time of exposure is immaterial.

It is quite impossible to give even a general rule of any service relative to the required time of exposure for negatives; it is only experience and attention to the symptoms of over or under-exposure, as seen in the development, that can afford the operator any valuable assistance on this important point. Negatives always require a longer exposure than positives: the light, the lens, and other circumstances, being the same, a negative might require from three to five times as long an exposure as a positive, and this with the negative collodion rather recently mixed.

THE NEGATIVE BATH.

It is highly probable that the bath made as directed further on (see "Negative Solutions" at page 58), will yield, at starting, very excellent results, but it is possible that it may not; it is certain that, after it has been used for a considerable time, it will deteriorate and require correction. It is necessary then to be able to ascertain the quality of the negative bath from the first, and to have the means of preserving it in good working order—nothing more simple, nothing more important. Take a piece of blue litmus paper, sold in little slip books, and immerse one end of it in the negative silver bath; if it turn reddish very rapidly, the bath is acid—much too acid for use; if the litmus assume a faint red appearance after an hour's soaking, the bath would most likely give fair results; but to produce the best effects, the nitric acid, which causes the reddening of the test paper, must be neutralized. Supposing that a pint of the silver solution have to be corrected—add to it four drops of strong liquid ammonia and shake it up; unless the bath is unusually acid, these four drops will be quite sufficient, not only to neutralize the acid, but to leave the bath slightly alkaline: now as an alkaline bath is highly objectionable, it is necessary to add a few drops of acetic acid (say two drops at a time) until the solution becomes neutral, or, what perhaps is safer for the beginner, *very slightly acid* with the acetic acid. By using the blue or red litmus paper, the state of the solution can easily be determined; acids redden the blue slips more or less rapidly as the acidity is greater or less; the red litmus paper is made by soaking the blue in a weak solution of acetic acid and then drying it; a slip of this immersed in an alkaline liquid has its blue colour restored. If on testing a new bath it be found to have an alkaline reaction, ammonia need not be added to it—simply a few drops of acetic acid, sufficient to give the blue test paper a red tinge after an hour's immersion.

An old silver bath is sure to be acid, and besides requiring correction for nitric acid, will probably be weak of silver; if not in very bad condition, and too small in quantity to pay for the trouble, add some nitrate of silver to it (about ten grains to every ounce), and then test and correct it as described.

From time to time, as the bath loses by use, it will require additions to maintain both its strength and quantity; it will be found sufficient to add occasionally a few ounces of distilled water, in which is dissolved nitrate of silver thirty grains to each ounce.

DEVELOPING THE NEGATIVE.

We have said, that, with the exception of a lengthened exposure and the substitution of negative for positive solutions, the two processes are conducted in precisely the same manner; but a very material difference in the manner of operating occurs when the intended negative comes to be developed.

For a plate measuring five inches by four, use about an ounce of the negative developing solution;* pour it into a clean measure, and, having carefully excluded daylight from the room, remove the exposed plate from the dark slide, hold it near the yellow light by one corner, with the face up, and pour the developing solution quickly all over the surface; any pause in the flowing of the solution will form lines and stains on the finished picture, so it is necessary to run it over from side to side very rapidly, by tilting the plate in different directions, until it is well covered.

In developing positives, the general fault with amateurs is, that the development is carried too far; but with negatives, under-developing is the common error. In order to avoid both evils, hold the plate, with the solution on its surface, in such a position with respect to the yellow light, that the image may be seen as a transparency and its negative character examined, and then again, by altering the position of the hand, the surface of the film only can be brought into view: the development can by these means be advantageously watched and stopped at the proper moment: as an instance, and presuming that a correctly exposed plate is being developed, first the high lights and whitest parts appear, and then gradually all the details; pour back the developing into the measure, hold up the plate between the eyes and the yellow light, and look through it; the lights will appear more or less opaque and the details faintly sketched in; restore the plate quickly to its horizontal position, and again pour on the developing, now getting discoloured; soon the picture will seem to be spoiling by the lights getting flat and obscure, but the negative is quite safe, so long as the very darkest parts, such as the shadows in a black coat, remain unaffected by the solution, and still retain the yellow semi-opaque appearance which every part of the film presented before the development. It is as well to keep the solution, while on the plate, constantly moving, to prevent unequal action and any decomposed particles from settling on the plate and causing spots: on this account, pouring the solution on and off the plate several times is of advantage, and further, allows one to examine the negative by transmitted light, as explained. The negative is properly and sufficiently developed when those parts of the picture which were white in the original are almost perfectly opaque in the negative—the darkest shadows remaining yellowish and unaltered under the influence of the developing solution, and the gradations of tone fully preserved.

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* See Negative Developing Solution, p. 59.

The development of a plate which has been properly exposed, is a much more simple matter than would appear by the description; indeed, it is almost difficult to spoil utterly a picture which has been nicely timed; on the other hand, any amount of verbal instruction would but imperfectly prepare the amateur for meeting and overcoming the difficulties of over and under exposed negatives; still there are one or two facts, the knowledge of which, with a little practice and a few failures, will be of great service to him.

Negatives which have been very much under-exposed are useless; they present the appearance of capital pictures when seen as positives, but as negatives the contrast of light and shade is too violent; in the vain attempt to bring detail into the shadows, the lights are, as it were, clotted; and the longer the development, the greater the failure: but when the time of exposure has not been much too short, the picture may often be saved by using a large quantity of the developing solution frequently changed: the image is formed by the precipitation of metallic silver on the parts of the plate which should be opaque, and this metallic silver is produced from the nitrate of silver already on the film: now if the nitrate be weakened by using an unusually large quantity of developing solution, the opacity, which is most to be dreaded with under-exposure, is delayed, and time given for the half-tones to develop themselves.

A negative which has been greatly over-exposed, bursts into sight at once on the developing solution being applied, and the image gets fogged all over immediately; there is very little contrast, the half-tones which photographers fall into raptures over, are there in abundance; in fact, it is all half-tone, no coaxing development can save it; but when the exposure has been within double the proper time, there are hopes of its redemption. Directly the image starts into view, which it will do, showing all the details at once faintly and with a reddish tint, wash off the developing by pouring on at least a pint of clean water; then take some fresh developing, and add to it about one-fourth part of nitrate of silver solution (30 grains to the ounce); pour this mixture several times on and off the glass: the red tint will leave the negative, which will turn black and be strengthened by this mode of procedure. If it still appear too weak and want contrast, the plate can be again washed, and again treated with a fresh mixture of silver and developing: a fresh mixture, as the compound of silver and developing decomposes almost immediately, and it is necessary to use it before the decomposition takes place.

FIXING AND FINISHING THE NEGATIVE.

Having sufficiently developed the negative image, wash off the chemicals with plenty of clean water, as described in the positive process, and also in the same manner pour on the cyanide fixing solution; this will soon clear off the iodide of silver from the shadows, but will leave intact the deposited silver which forms the picture. With another unsparing application of water, to remove the cyanide, the fixing is completed. It is advisable not to leave the fixing solution too long on the plate; directly the yellow iodide is dissolved, it has done its duty, and its presence after that is likely to prove injurious.

Negatives require varnishing, otherwise the film is apt to get scratched in the printing process. When the plate is perfectly dry, pour on the collodion side some amber varnish, and coat the plate as if collodion were being used, returning the excess into the bottle in the same manner. The varnish dries immediately.

FAILURES WITH NEGATIVES.

(*See "Failures with Glass Positives," Nos.* 1 *to* 9, *which apply equally to Negatives.*)

THE APPEARANCE OF THE PICTURE.	THE CAUSE.
1. The negative while wet is of a green tint by transmitted light, and not of sufficient intensity to print well.	1. The bath is acid with nitric acid; it can be corrected as directed under the head of "The Negative Bath."

2. The picture is of a pale red colour; details plain but weak, and the whole negative uniformly flat.	2. Over-exposed; the redness is due to the acetic acid, either in the bath or the developing; it is a much healthier sign than the green tinge produced by nitric acid in the bath.
3. Viewed as a positive, the picture shows very well; but as a negative the high lights are extremely dense, and there is no half-tone or drawing in the shadows.	3. Under-exposed. Contrary to what might be expected, the shorter the exposure in the camera, the denser will be the negative; a longer exposure will soften down the great density of the lights, and bring detail into the shadows; a still longer exposure fogs the latter, weakens the former to too great an extent, and destroys the contrast which should exist in the finished picture.
4. Good as a positive; the shadows transparent, and the lights weak.	4. Not sufficiently developed. A good negative seldom shows much distinctness as a positive.
5. The picture is very dense all over; the shadows are not transparent enough.	5. This may print tolerably well, but very slowly; it is over-developed.
6. The blacks are transparent, the whites extremely dense, and it neither looks well as a positive nor as a negative.	6. Under-exposed and over-developed.
7. On holding the plate up to the light, stains like curtains or fringes appear; the same effect, to a less extent, is seen by reflected light.	7. Bad collodion: try another sample. The defect can be mitigated, but not altogether removed, by lengthening the time between the coating of the plate and immersion in the silver bath.

8. On developing, the picture becomes obscured by a dark, heavy cloudiness.	8. Most probably the silver bath is alkaline; add to it one or two drops of glacial acetic acid.
9. A foggy veil all over the picture, not produced by over-exposure.	9. The slides or camera are not light-tight, or there is too much light in the dark room. A similar effect is sometimes produced when the collodion has been very recently iodized, if the object copied reflect much light; in such a case, older collodion may be used, or the opening of the lens-tube made smaller by inserting a diaphragm. (See "Out-door Photography.")

PHOTOGRAPHIC PRINTING.

A NEGATIVE produced by the process just described would be useless, unless there were some method of transferring, and at the same time reversing, the impression. In principle, the matter is simple enough, but the very different results, as regards quality of print, obtained by different photographers, show that a considerable amount of taste and discrimination is required, in order to produce really first-rate impressions.

Having obtained a good negative, it would, perhaps, be too great a tax on the amateur's patience and forbearance to request him to put it aside, and begin his printing with more simple subjects; but there will be no difficulty, if he have taken the advice given at starting, and will make printing his first step in the art.

A very strong solution of nitrate of silver, spread with a brush over white paper, is tolerably sensitive to light, and good copies of lace and other similar objects can be made by using it; further, it only requires to be soaked in warm water, in order to fix it. For general purposes this paper is not sufficiently sensitive; and, by a little more trouble in preparing and fixing, papers can be made better in many respects and very much cheaper.

Take a sheet of the unprepared photographic paper—not the glossy albumenized paper—and cut it into the sizes required, marking with pencil the wrong side of the paper, that it may afterwards be easily distinguished; the wrong side is known by its having a sort of fine pattern—a very small check or network. We will suppose that there are a dozen pieces of paper to be prepared; first, they have to be "salted," an operation which may be performed by daylight, but in a room where there are no dust and "blacks" floating about.

SALTING THE PAPER.

In a clean porcelain dish pour a pint of water, in which has been dissolved 300 grains of common table salt (chloride of sodium); immerse a piece of the paper face up in the solution, without fingering it more than is necessary; take care that the salt water wets the paper in every part; air-bubbles resting on the paper will cause blemishes on the print, these must be blown away, or the water agitated by moving the dish until they disappear; place the other pieces in the solution in the same manner, one over the other, until they are all in the dish, then taking them together by the corners, turn them all in a mass, so that the sheet first immersed shall be at the top, and the last piece at the bottom of the dish; let them soak at least five minutes, then take them out one by one, commencing at the top, and hang them up by one corner to dry. Pins will answer very well for hanging papers; they can be thrust through one corner and stuck into a shelf, and so arranged that the sheets shall not come into contact with each other, nor one part of the same paper with another part. The salt solution can be put into a bottle and saved for future operations. The dish or pan in which the papers were salted had better be kept for salting purposes only; in fact, every vessel used in photography should be dedicated to one service only, and never put to any duty but its own.

There is a glossy kind of salted paper, prepared with white of egg, and called "albumenized," which is much used for views, the preparation of which it will be necessary to describe. As a matter of taste, it is a question whether the varnished appearance of the prints produced on it be not objectionable; there can be little doubt, however, that great sharpness of detail can be secured by its aid, and no doubt at all that it is particularly adapted, by its fine surface, for stereoscopic subjects.

Small consumers will find it most economical to purchase their albumenized paper ready made; but if a little trouble, and, probably, at first, an inferior kind of paper, are not objectionable, proceed thus:—Take the whites of several fresh eggs—the number according to the quantity of solution to be made—put them all together in a clean basin, and add an equal bulk of distilled or filtered rain water. If the paper be required very glossy, less water can be used. To every ounce of the mixture add eight grains of the chloride of ammonium, and then whisk the whole of it into a froth with a silver or wooden fork; cover the basin from the dust, and allow the froth to subside, which it does in about twelve hours, then pour off for use the clear portion of the fluid, and filter it through muslin.

The paper to be albumenized should be floated on the thick fluid for a short time, say a minute, and great care taken to prevent the formation of air-bubbles and dirty stains. Let the paper hang to dry in a warm place perfectly free from dust.

When dry, the salted papers, including the albumenized, can be kept in a portfolio for any length of time without injury.

EXCITING THE PAPER.

Make a solution of nitrate of silver, forty grains to every ounce of distilled water, and mix at least sufficient of it to cover perfectly the dish intended to be used; then take a clean and dry porcelain pan, and pour the silver solution into it. Turn up one corner of a sheet of the salted paper, and holding it by the corner, let the opposite corner down upon the silver, and gradually lower the hand, that the whole surface of the paper may be in contact with, and floating on, the solution in the dish; the wrong or marked side should be uppermost and quite dry. At first the paper will be inclined to curl up at the ends, but after a little time they subside; then, taking the paper by the turned-up corner, half draw up the paper, and observe if it be free from air-bubbles; if not, by drawing it across the solution and blowing the bubbles, they are easily got rid of. The paper should remain in the silver solution from three to ten minutes, according to the desired sensitiveness; floating for a short time will make it less sensitive, and the picture will be of a different tone than if it had been in contact with the silver for a longer period.

The papers should be made sensitive in a place where the daylight is obscure; they are not so extremely susceptible to the action of light as the collodion plates, but it is advisable not to expose them to its influence while they are being prepared. When the paper has been in the silver bath for a sufficient time, remove it carefully by the turned corner, and hang it up to dry in a perfectly dark place. Pins are too liable to produce stains in the corners when they are hanging by them, therefore another arrangement should be made; perhaps the small wooden clips or American clothes pegs are the best things which can be used: several may be slung on a cord, and one corner of the silvered paper clipped to each.

The silver solution can be used again and again for other papers, it only requires occasional strengthening with a few grains of nitrate of silver; that is, if the quantity made in the first place were considerable; otherwise, most probably, the quantity, as well as the quality, will require renewal.

The effect produced on silvering a salted paper should be known: common salt thrown into a solution of nitrate of silver causes a thick white cloudiness, or precipitate of chloride of silver: the same result is attained on the salted paper coming into contact with the silver solution—the white insoluble chloride of silver is formed on the surface, and, to some extent, in the substance of the paper, and renders it much more sensitive to the action of light than paper prepared simply with the nitrate alone. It is found that the chloride papers reach their maximum sensitiveness when all the salt is decomposed—turned into chloride of silver—and there is also on the paper an excess of nitrate of silver.

It should be mentioned that floating the paper on the solution is not the only plan which can be adopted; many prefer using a brush to spread the silver solution over the paper; its principal, if not only advantage, is in the present economy of the nitrate of silver, as a very small quantity of solution can be made at a time, and used to the last drop; its great objection is in its liability, in inexperienced hands, to cause streaks across the picture corresponding to the course of the brush in exciting the paper.

To use the brush, place the sheet of salted paper on blotting paper, and both on a smooth flat board; and then, having dipped the brush into the silver solution, brush it quickly, evenly, and in one direction, all over the paper; in two or three minutes brush over it again, crossing the course taken by the brush on the first application; after about two minutes' soaking, hang the paper up to dry, and proceed with others, if more be required.

The brush should be rather large and not bound with tin or brass, any of the inferior metals producing decomposition of the nitrate of silver; it must be kept extremely clean, which can only be effected by well washing it in distilled water after it has been used.

When brushing the paper is preferred to floating it, the silver solution must be made rather stronger than for the latter purpose; instead of 40 grains silver to the ounce of water, say 60 grains to the ounce for the brush; and in other cases, where the strength of silver is given for floated paper, add about fifty per cent. to the quantity of silver; in every instance, it is supposed that the salting has been done by soaking or floating.

In order to produce variety in the tones of the finished prints, different salts to that recommended, and different proportions, are found useful; with a view to this, a selection of formulæ for printing papers is appended.

1. Salt with 20 grains chloride of barium dissolved in every ounce of clean common water, and when the paper is dry, float it on 40 grains nitrate of silver to every ounce of distilled water.

2. Salt with 10 grains chloride of ammonium to the ounce of water; silver with 45 grains nitrate of silver to the ounce of distilled water.

3. Salt with eight grains chloride of sodium to the ounce of water; silver with 25 grains nitrate of silver to the ounce of distilled water.

4. Salt with five grains chloride of ammonium to the ounce of water, and, for one ounce of silvering solution, dissolve 30 grains of nitrate of silver in half an ounce of distilled water, add cautiously to it, a drop at a time, strong liquid ammonia, which will at first cause a brown turbidness, but by increasing the dose of ammonia and agitating the mixture, the precipitate will be re-dissolved; when this is barely effected, so that there is still a slight cloudiness in the solution, enough ammonia has been used; add sufficient distilled water to make up one ounce; the solution can then be used in the ordinary manner.

The silvered papers should not only hang to dry in the dark, but must afterwards be strictly preserved from the light until required for use, nor should their use be long delayed, as they have a tendency to spoil, even when kept carefully in the dark; their keeping qualities are in proportion to their sensitiveness. some of the most highly sensitive, as the ammonia-nitrate papers, and others prepared with the strong solutions, get discoloured and unfit for use within forty-eight hours of their preparation, and few of them will remain in good condition for more than a week.

THE PRINTING FRAME.

We will suppose that the first use to which the printing frame is put is in copying a piece of black lace. Take the copying frame into the dark room, or any place where the light is rather obscure, and place it on a table, glass downwards; turn back the pressure-bars, remove the hinged back-board, and clean the plate glass; then place on it, in the centre, the lace which is to be copied, on this a rather larger piece of prepared paper with its sensitive side in contact with the lace, and on the back of the paper a piece of velvet, cloth, or similar soft material; replace the back and fasten down the bars; if the bars have springs on them, the arrangement is ready for exposure, but some copying frames are provided with screws instead, in which case they will have to be tightened, in order to bring the sensitive paper and the lace into perfect contact; on turning up the glass side of the frame and exposing it in the best light at command, a change will very shortly be apparent in the sensitive surface, the margin of the paper, and those parts of it seen between the interstices of the lace, will gradually darken, until they finally assume an olive-green colour; when this colour is attained, the printing operation is finished.

The time required in printing of course depends on the light and the preparation of the sensitive paper; the exposure may range from ten minutes to twelve hours.

On removing the sensitive paper from the frame, a perfect copy of the lace will be found impressed on it, but it will appear as white lace on a dark ground; in fact, it is a paper negative. It will be evident, that if the print just obtained be kept in the light, the white will gradually darken, and the picture be obliterated; it therefore requires to be "fixed;" the fixing process is explained further on.

Leaves, feathers, and engravings, can have negative copies taken of them in exactly the same manner as that just described. With an engraving, a little extra care is required; the back of it must be clean and not have any printing on it, and in order to get good copies the paper should be tolerably clear; some old prints which are yellow with age, and mottled in the substance of the paper, cannot be successfully copied by superposition. The engraving should be placed with its back to the glass of the pressure-frame, and its face in contact with the sensitive side of the prepared paper, which latter may be a little larger than the engraving, to allow a margin to be seen during its darkening in the light; when this margin has been quite bronzed in the sun, one of the pressure-bars can be undone, one of the hinged doors turned back, and a hasty glance taken at a part of the photograph. It is necessary to overprint in the copying, in order to allow for the fixing process, which lightens the prints to a considerable extent. If the copy of the engraving in the white parts be much darker than the original, it is probably printed sufficiently, and can be removed from the frame and fixed; but if it be not dark enough, the door and bar can be replaced, and the frame again exposed to the light; the engraving is supposed to be fixed in the centre of the copying frame, so that when one of the bars and one of the hinged doors are opened, the pressure of the other bar keeps the engraving and the prepared paper from shifting; the half of the copy which has been looked at falls into its former position when the arrangement is fastened up again; still it is advisable not to open the frame oftener than is necessary.

In order to make *fac simile* copies of the engraving, the paper negative, after fixing, washing, and drying, has to be treated in precisely the same manner as was the original from which it was produced; it is put into the frame with the plain side to the glass, and its printed side to the sensitive paper, and this, when exposed, will give a positive copy of the engraving.

In printing from negatives on glass, place the uncoated side in contact with the plate glass of the frame, and the collodion side next to the silvered side of the prepared paper, on the paper the cloth or velvet, and the whole pressed tightly together by the back-board and bars of the copying frame; the progress of the printing can be occasionally watched by opening one half of the frame as described. As a rule, it is necessary to overprint; the extent of the overprinting depends on the subject and on the manner of fixing, but a few trials, and the appearance of the finished picture, will afford the most valuable lessons in the art of printing.

FIXING AND TONING THE PRINTS.

In the early days of photography, the greatest impediment to its progress was the difficulty of securing the photograph from the action of the agent which produced it; the light-drawn picture could not be exposed without being obliterated by the darkening of the light parts of the photograph. Something was wanted which, by dissolving away the chemicals in the unaltered parts of the picture, would prevent further action of the light. Many chemical solutions were known which had this dissolving power, but they had also the unfortunate property of dissolving the darkened parts also. After many chemicals were tried, it was found that a solution of hyposulphite of soda was a perfect solvent of the white chloride of silver, but had scarcely any effect on the reduced silver forming the dark parts of the picture. With the knowledge of this fact, the operator's course, after printing his photograph, is very plain; he steeps the print in a solution of hyposulphite of soda, then washes it to remove the "hypo," dries it, frames it, and then—admires it!

To a pint of water add three ounces of hyposulphite of soda: when the crystals are dissolved, the simple fixing solution is ready for use, and photographs may be fixed in it in ordinary daylight. On immersing a print in this solution, the chloride of silver in the whites is presently dissolved, the dark parts are lightened, and a peculiar and rather disagreeable red colour given to the photograph. Now it is found, that after the hypo bath has been in active use for some time, and about thirty or forty prints fixed in it, that it begins to possess another property besides that of fixing: the newly prepared mixture gave none but red prints, but the old solution tints the photograph to any desired tone, from a warm brown to a greenish black, according to the time that it is left in the hypo.

The toning property of the hypo bath can be given to the solution at first, by mixing with it some nitrate of silver; dissolve 60 grains in an ounce of distilled water, and add it, a little at a time, to a pint of hypo, shaking the mixture between each addition, that the yellow precipitate may be readily dissolved. The colouring or toning power of this solution will be attained in some twenty-four hours after mixing.

Prints should not remain in the hypo for a shorter time than half-an-hour, and it will be safer to let them be immersed for a longer time,—say an hour. The operator must be guided by the appearance of the print; when it is lightened sufficiently, is of a good tone, and the paper does not appear mottled when held up to the light and looked through, then the photograph is properly fixed, and may be placed in a dish of water, previous to a final and more complete washing.

It will be found that prints taken on albumenized paper are much slower in losing the red tint than those on plain papers,—still it is only a question of time.

It is advisable not to carry the toning too far; very beautiful tones can be produced in the "old hypo bath," but experience shows that when permanence in the prints is an object, the rich blacks and creamy whites caused by a prolonged immersion in the bath must be avoided; the toning must be stopped when the redness of the print is succeeded by a deep brown; beyond this stage the print, however well washed, is liable to fade.

Instead of adding nitrate of silver to the new hypo bath, a better, safer, but not so economical a method, is to substitute chloride of gold—eight grains to the pint—which can be first dissolved in a little water, and then gradually added to the hyposulphite solution; prints take fine tones in this bath, and it is well adapted for albumenized paper; both this bath and the other previously mentioned, after much use, require to be diluted with water to compensate for waste, and strengthened occasionally by the addition of an ounce or two of the crystals of hyposulphite of soda; the bath now under notice should have a few grains of chloride of gold (in solution) added to it when its toning power seems to flag.

If the gold toning bath be much used, the nitrate of silver introduced into it from the prints will be objectionable, as being liable to cause the toning independently of the gold; in this case, it will be well to soak the print for an hour in a pan of clean water, directly that it is removed from the copying frame, and before it is immersed in the fixing solution.

For portraits on plain paper, perhaps the best plan is to use a toning and fixing bath separately; on taking the print from the frame let it be immersed in a pan of water, that the free nitrate of silver may be removed from the surface of the paper; this should be done in the dark room. After, at least, an hour's soaking, it should be put into a clean dish, with the following solution:—

Distilled water	10 ounces
Sel d'or	8 grains
Pure muriatic acid...	5 drops—Mix.

Prints intended to be toned in this solution should be only slightly overprinted. On their immersion in a new bath, they are very rapidly coloured, but as the gold by use is withdrawn, the toning action becomes slower. When the print has attained a pure black and white tone, it may be removed from the bath;—on no account should it be left in long enough to get blue, for, however well it may look while wet in the colouring bath, it becomes, after fixing and drying, of a dull heavy tone, and possesses no brilliancy. This toning process should not be conducted in a strong light.

On removing the print from the sel d'or bath, place it in a new solution of hypo (about one ounce of hypo to five of water), and let it remain until the paper seems clear when held between the light and the eyes,—probably about half an hour; then let it be placed in a pan of clean water. About a pint of the hypo fixing solution can be made at a time, and renewed when from twenty to thirty prints have been fixed in it; this is to prevent it attaining colouring properties, which it would do after very many prints had been immersed in it; in the present case it is desired that the toning should be with gold, and not by the decomposition of the hyposulphite of soda; hence the precaution of renewing the solution.

WASHING THE PRINTS.

A GREAT deal has been said and written on the subject of the fading of photographs; it has been clearly proved that, under certain circumstances, they *do* fade, and it has been equally clearly shown that by a proper understanding of the causes and common attention to the requisite precautions, fading need never occur. The causes of fading are three,—overfixing in the old hypo bath, insufficient washing, and improper mounting. We have already pointed out the propriety of withdrawing the prints from the hypo solution before the brown tint has left them; when they have assumed the slightest tinge of yellow in the half tones, there is no chance of their permanence.

The object of washing the prints is to insure the absence of the slightest trace of the hyposulphites of soda and silver; now the hypo, although very soluble in water, is most persistent in its adherence to the paper; it is not sufficient simply to immerse them in water; a means must be adopted that shall cause the water to act mechanically on the surfaces, and, as it were, to rub out, as well as soak out, the chemicals.

The quantity of water necessary for washing depends on the number and size of the prints; say that there are a dozen moderate-sized pictures, the ordinary method would be to put them all together into a large washing pan or foot-bath, place it under the water-tap, turn it half on, and let it run for a couple of hours; the prints would then soak for twelve hours in the pan of water, and be again subjected to the running stream for an hour or two, taken out, and hung to dry.

Another method is to place each print on a clean flat board under the water-tap with the stream full on it; having a clean sponge to keep saturating it with the water, and gently dabbing all over the print, doing both sides; prints on plain paper must be dealt tenderly with, or the surface may get rubbed up and the picture spoiled, but the albumenized prints will bear considerable rubbing without injury: having sponged and well sluiced the print for about five minutes, it is placed in a pan of water, the larger the better, and another submitted to the same operation, until they are all well rinsed and sponged; they then soak all together for eight or ten hours, and are again sponged and rinsed on another board, and with another sponge, when they may be considered perfectly washed, and hung by the corners to dry.

There are many plans for washing prints which may suggest themselves to the mind of the amateur; he will be guided by his convenience and the extent of his printing operations, but under any circumstances he must remember never to spare the water; the photographer must believe in, and extensively practise hydropathy, or be content to let his creations fade and perish before his eyes.

Paper photographs are generally mounted on card-board, and if paste be used—particularly sour paste—there is a liability to cause fading; gelatine may be used with safety.

HINTS ON PORTRAITURE.

THE position of a sitter, while it has generally the least attention paid to it by the amateur, is really the most important matter in photographic portraiture; be the photograph ever so clear, sharp, and well-balanced in light and shade, ever so beautiful in tone, or correct as a likeness, the production is valueless, unless it be accompanied with a graceful and characteristic *pose;* rules without examples can scarcely afford any assistance, and little more can be done, in a work like the present, than to draw the operator's attention to the subject, and to recommend him, if he wish to excel in this branch of the art, to study the many accessible works on art and composition as applied to portraiture.

With a view to their avoidance, a few of the most common enormities may be enumerated :—a stout old gentlemen is often placed leaning far back in his chair, and in consequence his portrait represents him as being three times stouter than he is, and graces him with an idiotically small head; he has a hand on each hip, so as to form exact angles on either side, and give him the appearance of a geometrical problem; his body is turned to the left, his head to the right, and his eyes vacantly staring in a direction between the two. Again: a tall, thin lady is made taller and thinner by being taken in a standing position; having a good shaped nose, a full face portrait is "done," and the outline of the nose lost; having fine eyes, she is made to look up, down, or in such a direction that their beauty may be lost.

Groups are frequently seen, with the sitters forming it either straggling all over the picture, or else arranged with mathematical precision in a straight line, as if with a desire to emulate the position of the youthful and hilarious butchers of the legend—"all in a row."

The most convenient place in which portraits can be taken is undoubtedly a glass room, built expressly for the purpose, with blinds and screens fitted to it in such a manner that any desired effect of light and shade can be produced; still very beautiful portraits can be and are made in the open air, and even in ordinary well-lighted rooms.

A little trouble and expense in procuring a proper background is repaid by the results; a blanket answers well for a light background, but it is rather too light in some cases; a grey head or light cap will seem to sink in the picture taken with it. Green baize backgrounds give great relief to the figure, when it is not darkly draped; but, as a rule, a colour should be chosen which, by contrast, will not impair either the purity of the whites, nor the depth of the shadows in the portrait.

Screens are indispensable to moderate the intensity of the light, and introduce a proper amount of shadow on parts of the figure; for a portrait taken in the open air, a screen—which may be a dark table-cover thrown over a clothes-horse—should be placed on one side of the sitter, and nearly at right angles with the background; very delicate shadows can be produced by its aid. Generally, open air portraits have too much top light, causing heavy shadows in the eyes, and under the nose and chin; in such cases, the remedy is found by using a dark screen over the head of the sitter, projecting from three to five feet from the top of the background.

When a portrait has to be taken in an ordinary room, it will be found necessary to fix a white or light blue screen in a parallel line with the window, and place the sitter and background in the space between the two, with the light full on the face; the object of the white screen, which may be a sheet, is to throw back a portion of the light from the window on one side of the sitter's face, which would be too deeply in shadow without some reflected light.

The focus of a portrait lens is very limited in depth; that is, it will not produce sharp and well-defined images of objects which are at different distances from the camera, if one be in focus, the other will be out; this want of depth increases as the objects are brought nearer to the lens; hence the necessity for placing the sitter with care, that the hands and face may be nearly on the same plane, and that no part of the arrangement may project towards, or recede very greatly from, the camera; not only will those parts be indistinct, from being out of focus, but they will also appear much distorted.

The colour of the background and dresses of the sitter greatly influence the time of exposure in the camera: a plate which would require thirty seconds' exposure, if the background were very dark and the sitter clad in black, would, in the same light, be over-exposed in twenty seconds with a light ground, and light coloured drapery; now a light colour, in a photographic point of view, is not always what is commonly considered a light colour; yellow is light, but yellows scarcely have any effect on the most sensitive plate, and the result is black; reds are very nearly as dark; but blue, even when deep in tone, produces an effect almost identical with white. It being understood that yellow and red draperies develop darker, and blues lighter than they really are, and that these three colours are components of all other colours, it is then easy to judge the effect of any compound colour; for instance, light green and purple produce medium tints, unless the yellow in the former, and the red in the latter, be in excess, in which cases the results will be dark.

Head-rests are highly useful, when properly managed; the most simple form of rest can be screwed on the back of a chair and easily adapted to the position of the sitter; it should be fastened without pushing the head forward, or otherwise giving the sitter an awkward and constrained appearance.

The portrait camera should be kept in good condition, dusted out occasionally, and examined as to its being light-tight; the lenses will also require attention and careful polishing with wash-leather.

The camera, when in use, must be carefully screened from sunlight with the focussing cloth; when the dark frame, carrying the prepared plate, is inserted in the camera, the cloth can be thrown over it, and the slide drawn up under the cloth, to prevent any light finding its way to the plate through the crevice in which the slide moves.

Sunlight falling on the lenses causes fogging on the lower half of the plate: the face of the sitter may be brought out clearly, but the lower part of the figure will be in a mist; to prevent this disagreeable effect, the sun must be screened from the lenses, either by a dark blind above or an addition in length to the front of the brass-tube; a card-board or tin-tube, about three inches long and blackened inside, can be made to fit over the brass, and draw in or out, as far as may be required, to shield the lenses from the glare of light.

OUT-DOOR PHOTOGRAPHY.

The old calotype and wax-paper process each have their supporters in a claim for superiority over the collodion process in open-air operations; they certainly have an advantage in the ease of the manipulations, and the small quantity of apparatus which the operator requires to carry with him in a photographic campaign; but as he does not develop his picture on the spot where it has been taken, he is never *certain* of a good result, and can only discover a failure on his return home, when he may be miles from the coveted view; add to this a consideration of the want of sharpness and half tone observable in most paper negatives, and the amateur will not hesitate to adopt the more troublesome, but in most respects more satisfactory, negative collodion process for views as well as portraits.

Cameras for views are made in a variety of forms; the best are those which combine portability with firmness: stability and a degree of weight proportionate to its size are necessary, to prevent a camera from being moved or blown over by a puff of wind; the same remark applies to the camera stand. For views above four inches square, a single achromatic lens is used; but for sizes less than this, such as stereoscopic views, the double arrangement, or what is called the quarter-plate portrait lens, answers almost, if not quite, as well.

As the plate, in the ordinary collodion process, requires to be coated, excited, exposed, developed, and fixed, all within about half-an-hour, and the operations performed in the dark, it is evident that the photographer must carry his dark room with him: portable dark tents are procurable, in which the manipulations can be made almost as easily and surely abroad, as in the most conveniently arranged dark room at home.

Having pitched the tent, arranged the apparatus required to be used in it, and focussed the view, the operator proceeds to take it in the same manner, with a few exceptions, as recommended for portraiture. The exceptions—only two—are most important; the collodion must generally be old, and the use of the diaphragm must be well understood.

The finest views are doubtless taken in bright weather, with collodion iodized at least a month before using; it is slow in its action, sometimes requiring three or four minutes' exposure, but the delay is fully compensated for by the improved results; when instantaneous views are required, freshly iodized collodion must be employed, at the risk of fogging and heavy pictures.

All view lenses are provided with diaphragms or stops; these are circular pieces of blackened metal, which fit into the front of the lens-tube, they have openings of different sizes in the centre, so that when fastened in the tube the whole of the lens may be covered, except a spot in the middle; these openings generally range from a quarter of an inch to an inch and a half in diameter, their use is to diminish the amount of light entering the camera: a certain quantity only is required to bring about the desired change on the sensitive plate, and it is found that the more this portion of light is confined to the centre of the lens, the better will be the effect; the smaller the central opening in front of a lens, the more brilliant and distinct will be the picture, not only at one point, but all over it. The size of the diaphragm used with the lens must be regulated entirely by the illumination of the view: the more powerful the light, the smaller should be the stop employed.

Satisfactory views cannot be taken on a misty day, but dull weather is not objectionable, if the atmosphere be clear; in such a case a medium-sized stop should be used, and the time of exposure lengthened, but not greatly; more negatives of views are spoiled by over than under exposure.

A great advantage of the ordinary collodion process is in the fact, that one is speedily made acquainted with the result; if a failure, another can at once be taken; its principal objection is found in the necessity for taking so much apparatus into the field; many photographers, impressed with the inconvenience, choose one of the many processes which will allow them to take out in the morning a number of prepared plates, expose them when desired, and develop them in the evening, or on the next day; boxes, bottles, tents, &c., are then not needed, and all that is required is to make as sure as possible that the exposure of the plate is properly timed. The ordinary or wet collodion process cannot be used thus, as the sensitive plate rapidly deteriorates, and within an hour of its preparation is useless: this is caused by the unequal drying of the plate, and by the concentration of the free nitrate of silver on its surface.

We require then, either wet collodion plates which shall not dry spontaneously within a moderate time, or dried plates freed from nitrate of silver, and with their surfaces protected by a film soluble in water. The action of the protecting film is not very evident, but its service is beyond a doubt; for although sensitized plates washed and then dried can have pictures taken on them without further preparation, still the results are generally very inferior, and it is almost impossible to prevent the films from being washed from the glasses.

Mr. Shadbolt's honey process is one that is very extensively and successfully practised; the manipulation is as follows:—Clean the plate, coat it, and sensitize in the usual manner, and then immerse it in a bath of distilled water, washing more or less thoroughly as it may be required to be kept for a longer or shorter time; after washing, pour on the plate a solution composed of equal parts of honey and distilled water; let the solution cover and fill the plate while held in the hand in the same manner used for coating with collodion; throw away the syrup and repeat the dose, letting it soak in for one or two minutes;

return the honey solution to its bottle, drain the plate on blotting paper, and keep it most scrupulously in the dark and free from dust. Those preserved plates require nearly double the exposure of those prepared in the ordinary manner. Previously to developing, it is necessary to remove or soften the film of honey, which should be done with distilled water: the older the plate, the more soaking is required; then dip the plate into the silver bath and develop in the usual way.

The dry process of Dr. Hill Norris produces most beautiful and certain results, and is extremely simple in the working;—after sensitizing and well washing the plate, pour over it two or three times a hot solution of gelatine, rear it up on end to drain and dry, when it will keep for months before and after exposure: just before developing, wash the plate with distilled water, and develop as usual with pyrogallic acid solution, to which is added a few drops of the silver bath. The strength of the gelatine solution does not appear to be very material, but it should be strong enough to gelatinize on cooling.

Our account of the dry processes would not be complete without including that of M. Taupenot, one of the first and still one of the best in use; its principal, perhaps only, drawback is in the trouble and delicacy of the manipulation.

The plate has to be cleaned and coated with the negative collodion in the usual manner, and afterwards excited in the negative silver bath. On removing the plate from the silver bath, wash the film thoroughly, by pouring over it some distilled water, which removes the excess of nitrate of silver; now pour on the film a quantity of iodized albumen, sufficient to cover it; tilt up one corner of the plate, and allow the small excess of albumen to return to the bottle in which it is kept.

The iodized albumen is made as follows:—Take any quantity of the white of fresh eggs, and to every fluid ounce add ten grains of iodide of potassium; beat the whole of it into a froth, and allow it to settle for twenty-four hours; filter through linen, and it is fit for use.

A number of plates should be coated at one time, placed in the dark, and leaning against the wall to dry; great care should be taken that they are well screened from dust. These plates will take several hours to dry, unless heated by a spirit-lamp or before a fire; they are very slightly, if at all, sensitive to light, and may be kept for months without injury.

To excite a collodio-albumenized plate, plunge it into a silver bath kept for that purpose only, and made as follows:—Sufficient distilled water nearly to fill the gutta percha vessel; to every ounce of water 50 grains nitrate of silver, and one fluid drachm of acetic acid. Let the plate remain in the bath for two or three minutes, then remove it, and wash lightly with distilled or filtered rain-water, the more perfect the washing, the longer the plate will remain in good condition, but the longer will be the required exposure in the camera; for a plate which has to be used within twenty-four hours of being excited, a pint of water will be an ample supply for washing a medium-sized plate.

The plate is now highly sensitive to light; place it vertically in a dark place, and allow it to dry spontaneously. A number of plates can be prepared in the same manner, and, when dry, used immediately, or kept for several days, or even weeks, if they have been thoroughly washed after their first and second immersions in the silver bath. They can each be kept in a separate dark slide, fitting to the camera, or, what is better, carried (a number together) to the scene of operations in a light-tight grooved box; in the latter case, the operator must provide himself with a black bag, into which he can introduce his arms, the box of plates, and the dark slide, to enable him to fix a sensitive plate in the slide for use in the first place, and, after exposure, to withdraw it and replace it with another. The bag must be provided with two elastic arm-holes, and made in other respects perfectly light-tight. Very little difficulty will be found in changing the plates in a bag of this description—nothing more is required than a little method; the exposed plates being placed by themselves at one end of the grooved dark box, and the excited plates at the other, with the coated sides all turned in one direction. Expose in the camera for about double the time required in the ordinary wet process.

On returning home with a box full of exposed plates, they may either be developed at once, or put by until the first convenient opportunity within a few days, according to the previous preparation.

Perhaps the best way to develop these negatives is to use the ordinary pyrogallic developing solution first; then, after a minute or two, to pour it back into the measure, and pour on the film, from another glass, a little of the silver bath solution, diluted with twice its own bulk of distilled water; return the nitrate to its glass measure, and again pour on the pyrogallic: keep repeating the process, alternately using the pyrogallic and the silver, until the picture is properly developed, which may be in from ten to fifteen minutes.

After well washing the developed picture, fix it by immersion in a shallow dish containing a solution of hyposulphite of soda—about three ounces to the pint of water; in a few minutes the yellow iodide will have been cleared from the film; the plate can then be removed from the hypo, washed, dried, and varnished, in the same manner as are ordinary collodion negatives.

STEREOSCOPIC PHOTOGRAPHY.

We have no intention of entering into an account of the laws of binocular vision, or their application to the stereoscope; our duty lies rather with the practical, than the theoretical; and in giving simple instructions for producing stereoscopic pictures, we attempt no more than our task imposes.

For use in Sir David Brewster's lenticular stereoscope there are required a pair of pictures identical in subject, and differing only in one respect—the visual angle: one photograph should faithfully represent the object as seen with the right eye, and the other the same object as seen with the left eye; the optical arrangement of the stereoscope combines these two one-eyed views, and gives the marvellous effect of a perfectly solid reproduction of the original,—a single picture, or rather model, of the object as viewed with both eyes at once.

The taking of such right-eyed and left-eyed photographs is obviously simple enough; by placing two cameras of equal sizes and focal lengths, opposite to the object, and at a distance equal to that between the eyes (about two and a half inches), the views thrown on the ground-glasses must necessarily represent the two dissimilar pictures required for the stereoscope; and by manipulating with collodionized glasses, in the ordinary way, they can be secured.

It is very important, when two cameras are used, that the lenses should be of exactly the same focal length, otherwise the images photographed will not be of the same size, and will not be suitable for the stereoscope; the apertures of the lenses should also be equal; and, in short, the conditions of the plates, exposure, &c., should be precisely the same for both cameras. But there is another method, by which an extra camera is not required; a dark slide, made for the purpose, is attached to the back of a small-sized camera, and into this slide can be fitted a long narrow plate of glass, sufficiently large to take in, side by side, the two dissimilar views; a very simple arrangement allows one-half only of the plate to be exposed at one time; so, having focussed the right-hand view, half of the sensitive plate is first impressed, then the cap placed on the lens; the camera is now moved 2½ inches to the left, and the slide shifted, that the unexposed half of the plate may be brought into position; the cap is then again removed, and the left view taken. This is a very convenient arrangement, and one generally adopted for views; but for portraits, or in other cases where the exposure must not occupy much time, two cameras are preferable.

In using two cameras, it will be necessary slightly to incline them inwards, at such an angle that the pictures on the ground-glasses shall each include the same object; to ensure this, a line can be drawn longitudinally down the centre of each ground-glass, and, in focussing, care taken that the object which is on or near the line in one camera, shall occupy the same position in the other. It is equally necessary with the single camera, that the two pictures produced in it should be taken at an inclination towards the same point; and for the purpose of facilitating the angular arrangements, many ingenious plans have been devised; perhaps the best is one where the the camera is attached to two sliding bars, which allow a rapid and exact movement of the camera left and right, with the required inclination to a common centre.

There exists a great difference of opinion among photographers as to the proper distance at which the cameras should be placed, the one from the other: theorists cannot discover a single reason why the distance between the eyes should not be taken as a standard, and never, under any circumstances, departed from; for it is evident that a stereoscopic view, the two pictures of which were taken three or four feet asunder, can hardly be a correct copy of the scene as viewed by ordinary eyes placed in the ordinary position; such a view, however wonderful for its great relief and apparent solidity, appears rather as a copy of a card-board model of nature, than a transcript of nature itself. Portraits taken with the instruments placed far apart, produce monstrous effects—noses and necks of unnatural lengths, and other distortions, equally offensive to truth and good taste. Notwithstanding all this, in practice it is found necessary—in order to produce a striking stereoscopic effect—to depart from the rule, and frequently to exceed two and a half inches as the distance between the two cameras, or the two positions of one shifting camera. The greater the distance from the object, the greater may be the distance between the cameras; at a distance of ten feet from the object, the cameras may be placed three inches apart—measuring from one lens-tube to the other; at fifteen feet from the object, the cameras may be four inches asunder, and for every additional five feet an inch added to the distance between the cameras; but stopping when the separation amounts to eighteen inches. This is, at least, a safe arrangement, and, without being scrupulously exact, the operator who is guided by it will not fail to get a satisfactory stereoscopic result.

The beauties of sterescopic photographs are so well appreciated, that it is almost unnecessary to speak a word in their favour; yet we cannot refrain from directing attention to the ease with which the photographer can secure these miniature reflections of nature; portable sets of apparatus are made specially for steroscopic views; the camera, chemicals, &c., pack into a small knapsack, and the tent folds up into a compass little larger than that of a gig umbrella, and is of much less weight; the amateur who is familiar with the collodion process, by the aid of this convenient, light, and highly portable apparatus, is enabled to furnish his stereoscope with a variety of views, the beauties and truth of which far exceed the largest and finest productions of the photographer, who, in search of the gigantic, may bring his apparatus to the field by horse loads.

SOLUTIONS USED IN THE COLLODION PROCESSES.

THE safest and most economical course for the amateur to pursue, in the matter of chemical solutions required in the art, is to purchase, at a respectable house, a small stock ready mixed; he will then have to contend only with difficulties purely photographic; adding to these difficulties a number of delicate chemical manipulations is to increase fourfold the impediments to success; these remarks apply more especially to the manufacture of collodion, which should not be attempted until considerable progress is made.

In weighing crystals and powders, a piece of clean white paper should be placed in each scale-pan, of equal size, that one may balance the other, and fresh paper used at every change of the chemicals weighed; this is to prevent the possibility of a minute portion of one chemical being mixed up with another; an unperceived atom of pyrogallic acid or sulphate of iron left in the scale-pan might find its way, with some nitrate of silver, into the silver bath and ruin it. Glass measures should be cleaned before and after using, and, if possible, kept for a certain distinct purpose; for instance, a small graduated measure should be kept for iodizing the collodion, and never put to any other use; bottles in which developing, fixing, and silver solutions are stored, should never be changed the one for the other; even their stoppers or corks must not be mistaken and misapplied.

The fingers must be well looked after, not on account of inevitable black stains, which, to a properly developed photographer, is a trifle, but because they are apt to come in contact with the hypo, and afterwards carry decomposition to the silver solutions. If blackened fingers be objectionable, the stains can be removed by rubbing them with a lump of moistened cyanide of potassium.

The silver baths, and some other solutions, occasionally require to be filtered; it is best done by folding a square piece of filtering-paper twice, in such a manner that, by partly opening the folded paper, a cone may be formed, which can fit into a funnel and allow the solution to filter through the paper.

Silver solutions which have had albumenized papers or glasses in them rapidly become discoloured, and no amount of filtering will clear them; the colour can be removed by mixing with the solutions some powdered china clay,—about one ounce to the pint; the mixture should be well shaken up, and afterwards put by, to allow the powder to settle, when the solution will be found quite clear and colourless.

In the following, as also in any preceding, formulæ, when speaking of fluids, it is supposed that the liquid is measured, not weighed; and in every instance where weights of crystals and powders are mentioned, the troy ounce (480 grains), drachm (60 grains), or scruple (20 grains), is intended to be used.

COLLODION.

To prepare the soluble cotton, put into a basin or mortar 520 grains of pure nitrate of potash, and reduce it, by rubbing into a fine powder; then moisten it with a drachm of water, and afterwards add two measured ounces of pure sulphuric acid, well stirring the mixture with a glass rod; then 30 grains of the finest cotton wool should be quickly immersed in it, a few fibres at a time; again stir up the mixture for about five minutes, taking care that every particle of the cotton is wetted by the pasty solution; now fill up the vessel with water, and quickly pour off the clear portion of the fluid; repeat this several times, and then take out the cotton, and well wash it in a large quantity of water, using a glass rod or paper knife to save the fingers from the effects of the acid. Every trace of acid must be removed from the gun cotton; and if, after long washing, the taste give evidence of acidity, the cotton may be soaked in warm water, frequently changed, for an hour or two.

When thoroughly washed, put the cotton into a clean dry towel and wring out as much as possible of the moisture, then pull the fibres out loosely, and put it in a warm place to dry, not a *hot* place, or the gun cotton may explode; when perfectly dry, it may be placed in a dry stoppered bottle, and preserved for use.

It will be necessary to make the soluble cotton in the open air, as the noxious fumes of the acid mixture are exceedingly unpleasant, if not injurious, in a confined space. The first washings of the cotton should be very quickly done, and care taken that the corrosive acid does not splash over the operator.

To five ounces of pure sulphuric ether add two ounces of absolute alcohol, shake it up, and dissolve in it about 30 grains of the soluble cotton; it may be added a few grains at a time, and the mixture thoroughly shaken; it should then be kept undisturbed for a day or two, to allow any undisturbed cotton to settle to the bottom of the bottle.

SOLUTIONS FOR GLASS POSITIVES.

Iodized Collodion.—The iodizing solution is made by dissolving 24 grains of iodide of ammonium, and 4 grains of bromide of ammonium, in an ounce of alcohol; to seven drachms of the plain collodion add one drachm of this solution, shake it up, and the positive iodized collodion is ready for use.

Silver Bath.—Dissolve 25 grains of nitrate of silver in two drachms of distilled water; in another vessel, dissolve half a grain of iodide of potassium in two or three drops of water, and add it to the silver solution; in an hour, put six drachms of distilled water to the silver and iodide mixture, and well stir it up; let this stand for three or four hours, and then filter it through bibulous paper; with the clear filtered solution mix eight drops of alcohol, and half a minim of glacial acetic acid. This will make only one ounce of the silver bath; for a greater quantity, multiply all the proportions equally, and proceed in the same manner.

DEVELOPING SOLUTION.

Sulphate of Iron ...	15 grains	Dissolve in one ounce of distilled water.
Glacial Acetic Acid	15 minims	
Alcohol	10 minims	

This solution will give chalk-like whites on the positives; when a metallic appearance is desired, it can be produced by lessening the amount of acetic acid and substituting nitric acid; instead of 15 minims of acetic acid to the ounce, use 10, and from half a minim to one minim of nitric acid.

FIXING SOLUTION.—Dissolve 40 grains of cyanide of potassium in 10 ounces of water. The cyanides are highly poisonous, as are also most of the chemicals used by the photographer; care should therefore be taken that they do not come in the way of children, or persons ignorant of their dangerous properties.

NEGATIVE SOLUTIONS.

IODIZED COLLODION.—Dissolve 30 grains of iodide of ammonium in one ounce of alcohol; this is the negative iodizing solution—it requires to be filtered before using. To make one ounce of negative collodion, add one drachm of the iodizing solution to seven drachms of the plain collodion, and well agitate the mixture.

SILVER BATH.—In two drachms of distilled water dissolve 35 grains of nitrate of silver, and add to the solution about half a grain of iodide of potassium, dissolve in a few drops of water; iodide of silver will be precipitated at first, but afterwards dissolve by the strong solution of silver; in an hour or two, make up the quantity to one ounce by the addition of distilled water; again iodide of silver will be precipitated. In a few hours the solution may be filtered, and five drops of alcohol added to it, when it will be ready for use.

No one will be likely to conduct photographic operations on so lilliputian a scale that only one ounce of the silver bath would be required; we give directions for making one ounce, but one gallon can be made in the same manner, by increasing all the quantities.

DEVELOPING SOLUTION.

Pyrogallic Acid ...	1½ grain	Dissolve in one ounce of distilled water.
Glacial Acetic Acid	8 minims	
Alcohol	10 minims	

The solution will keep well for at least a fortnight, but acts better when freshly mixed.

Fixing Solution.—The same as for positives, but it will not hurt if stronger, say from five to ten grains of cyanide of potassium to the ounce of water. Many operators prefer hyposulphite of soda for fixing negatives; it is best used by dissolving four ounces of hyposulphite in eight ounces of water; the solution is kept in a dish, and, after developing and washing, the plate is immersed in the dish, and removed when the yellow iodide is cleared from the film. The hypo fixing can be used again and again, until it becomes too weak for use.

In the preceding pages, much useful, although theoretical, information has been necessarily omitted, rather from a fear of rendering so elementary a work uninteresting and unintelligible, than from a want of due appreciation of its importance. But the student who, having mastered his "A B C," still thirsts for photographic knowledge, may fully satisfy his cravings by consulting Hardwich on Photographic Chemistry, Brewster on Optics, the Prize Essay on the Stereoscope, and the monthly numbers of the Journal of the Photographic Society.

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THE LONDON STEREOSCOPIC COMPANY have arranged Sets of Apparatus and Chemicals, which on account, of their completeness, will be found especially suitable for Amateurs and Professional Photographers, they contain every requisite for the art, and are fitted in cases carefully arranged for compactness and portability.

No. 1.—A SET OF APPARATUS.

Consisting of a Walnut Camera and good Lens for Portraits 4¼ by 3¼, with all necessary Chemicals for the Positive Collodion Pictures, with Book of Instructions	3	3	0

No. 2.—A COMPLETE SET OF APPARATUS,

With Double Achromatic Lens, mounted, with Rack and Pinion movement, and Warranted, Polished Walnut Camera for Pictures 4¼ by 3¼ and smaller, with two dark Slides and Carriers, Focussing Glass, Stand, Gutta Percha Bath and Dipper, Porcelain Washing Tray, Pressure Frame (improved), Box of Scales and Weights, 3 dozen Glasses, Filtering Paper, Measure, Funnels, and Test Papers, with the following Chemicals :—

Nitrate Silver.
Pyrogallic Acid
Glacial Acetic Acid
Crystal Varnish
Cyanide of Potassium
Alcohol

Iodized Collodion for Positives
Ditto for Negatives
Liquid Jet
Hyposulphite of Soda
Sulphate of Iron
Kaolin, &c.

The above in Glass Stoppered Bottles, well secured, Albumenized and Salted Paper, and a Book of Instructions, Packed in Box, with Lock and Key	5	5	0

No. 3.

A Set with strong and handsome Mahogany Camera, Double Achromatic Lens, by the London Stereoscopic Company, extra Chemicals, and the various Apparatus Papers and Chemicals enumerated in No. 2.

The above Camera has a dark slide with arrangements for Portraits 4¼ by 3¼, and smaller, or views 5 inches square.......... £6 6 0

No. 4.—A SET OF APPARATUS.

FOR TAKING STEREOSCOPIC PORTRAITS OR VIEWS.

A Walnut Camera and two back Frames, fitted with Double Achromatic Lens. Same Chemicals and Apparatus as in No. 2 5 5 0

No. 5.—SUPERIOR SET,

FOR STEREOSCOPIC PORTRAITS OR VIEWS.

With handsome Mahogany Camera, fine Double Achromatic Lens, by the London Stereoscopic Company. Chemicals, &c., &c., as in No. 3 .. .. 6 6 0

Where a Camera for Stereoscopic purposes only is required, it is impossible to have a more convenient, or more thoroughly useful instrument than the above, but if it be wished to take single portraits, as well as stereoscopic, the following set (No. 6) would be recommended.

No. 6.

The same with extra Back and Carriers, for Pictures 4¼ by 3¼, 3¼ by 2¾, 2½ by 2. Extra Chemicals, &c., &c., &c. 7 7 0

Parallel Bars for Nos. 4, 5, and 6, on Latimer Clarke's Principle, in Mahogany, 12s. 6d.

No. 7.

The same as No. 6, with the exception that the Camera is larger, and the dark slide for single Pictures, contains an arrangement for plates 5 inches square 8 8 0

No. 8.

With Polished Walnut Camera for Pictures, 6½ by 4¾, two dark Frames, 3 Carriers, a Focussing Glass, superior half-plate Lens (warranted), Stand, Pressure Frame, Bath and Dipper, Trays, Measures, Scales and Weights, Chemicals, Glasses, Paper, &c., &c., &c., complete 10 10 0

No. 9.

VERY SUPERIOR HALF-PLATE, POLISHED MAHOGANY

CAMERA.

With complete arrangements for Pictures, 6½ by 4¾, and smaller, Focussing Glass, and Back for Stereoscopic Pictures, superior Lens by the London Stereoscopic Company, Stand, extra Chemicals, &c., in Box, with Lock and Key 12 12 0

This Set will be found the most Complete and Useful yet introduced, and is especially recommended for India and the Colonies.

No. 10.

A Set containing the improved Bi-lens Camera in Mahogany, with a pair of corresponding Double Achromatic Lenses by the London Stereoscopic Company, and all the Chemicals and Apparatus necessary for Positive and Negative Pictures 9 9 0

The Bi-lens Camera is particularly useful for Stereoscopic Portraiture, as by its use, both Pictures are produced at one operation, thus much saving of time is effected, the time of sitting being reduced by more than one half, and the difficulty of preserving the same expression in both pictures is removed. The Lenses are so adjusted that the necessary angle can be obtained, and the very strictest attention is paid to their perfect correspondence. They may be fitted with stops for Landscape purposes at a small additional cost.

No. 11.—WHOLE PLATE SET.

Consisting of Polished Walnut Camera, whole plate Lens for Portraits 8½ by 6½, with Stand, Pressure Frame, and all the Apparatus and Chemicals required for the Negative and Positive Collodion processes, in box, with lock and key .. 15 15 0

No. 12.—A VERY SUPERIOR SET.

Consisting of a well made and handsome Mahogany Camera, (brass screwed), with warranted Double Achromatic Lens by the London Stereoscopic Company, for Portraits 8½ by 6½, and Views 10 by 8, a suitable stand, and all requisite Apparatus and Chemicals 21 0 0

MAHOGANY CAMERAS.

THE LONDON STEREOSCOPIC COMPANY direct particular attention to their superior Cameras: they are constructed on the most approved principles, and being all made of well-seasoned wood will stand any climate.

HORIZONTAL AND VERTICAL.

No. 1	for plates	5 inches	by	4	1	10	0
— 2	,,	6½	,,	4¾	2	0	0
— 3	,,	7	,,	7	3	0	0
— 4	,,	10	,,	8	4	10	0
— 5	,,	12	,,	10	6	10	0
— 6	,,	18	,,	16	12	0	0
— 7	,,	26	,,	24	25	0	0

SQUARE CAMERAS.

No. 1	for plates	4¼	by	3¼	1	12	6
— 2	,,	5	,,	4	2	0	0
— 3	,,	6½	,,	4¾	3	0	0
— 4	,,	10	,,	8	5	10	0
— 5	,,	12	,,	10	8	0	0
— 6	,,	18	,,	16	15	0	0
— 7	,,	26	,,	25	30	0	0

STEREOSCOPIC CAMERAS.

Latimer Clarke's Stereoscopic Camera, arrangement or parallel bars	3	0	0
Bi-lens Camera (for taking both pictures at the same time)	2	10	0
Small Mahogany Camera, for Stereoscopic purposes, as in set No. 5	2	0	0
The same, with back for small portraits 4¼ by 3¼	2	10	0

WALNUT CAMERAS.

		Vertical.	Square.
For Pictures	4¼ by 3¼	0 12 6	1 0 0
„	6½ „ 4¾	0 16 0	1 10 0
„	8½ „ 6½	1 5 0	2 2 0
For Stereoscopic			1 0 0

These are of Foreign Manufacture and though neither so well made, nor so durable, will in many cases be found sufficiently useful, they can be had polished at 20 per cent. extra.

Folding and Cloth Bodied CAMERAS in Stock, or made to order.

CAMERA STANDS.

Tripod, with folding legs, ball and socket movement and brass screws.

Quarter size	12 0
Half „	14 0
Whole „	17 6

OAK, ASH, OR MAHOGANY TRIPOD STANDS.

These may be had constructed on an improved plan, by which they are rendered exceedingly portable.

THE LONDON STEREOSCOPIC COMPANY have prepared an extremely light and elegant Stand suitable for all Cameras, from the quarter plate to those for pictures 18 inches square, equally suitable for the operating room and the field, Price—21s,

PRINTING FRAMES.

THE LONDON STEREOSCOPIC COMPANY'S Pressure Frames are of an improved and most useful construction, exceedingly strong and well made; the pressure is applied by means of spiral springs, and they are less liable to derangement or to break the negatior, than the flat spring commonly used.

PRINTING FRAMES.

With extra stout Plate Glass, Folding-back, Screws, or Springs.

Quarter size	0	4	6
Half size	0	6	6
Whole size	0	8	0
12 inches by 10	0	15	0
16 " 14	0	18	0
20 " 20	1	5	0

And larger sizes at proportionate prices.

PLATE BOXES.

(THESE ARE OF PINE AND BEST MAKE.)

	12 grooves.		24 grooves.	
¼ Plates suitable also for Plates, 3¼ by 2¾	2	6	3	3
5 by 4	3	6	4	3
6½ by 4¾	4	6	5	6
8½ by 6½	5	0	6	6
10 by 8	6	0	7	6
11 by 9	7	0	8	6
12 by 10	8	0	9	6
Stereoscopic	3	6	4	6

LENSES.

THE LONDON STEREOSCOPIC COMPANY have great satisfaction in stating that the Lenses, prices of which are here given, have been found to possess all the qualifications necessary for the production of a first-rate picture. They give a remarkably flat field, have invariably the chemical and visual foci coincident, and are rapid in their operation. The Company without wishing to detract from the merits of other manufacturers, confidently assert that better Lenses cannot be produced, either for quality of the glasses, or elegance of the mounts, they are all fitted with rack and pinion adjustments, and brass rings for the Camera, and are furnished when required with an improved form of diaphragm or stop.

The Double Achromatic Lens which is chiefly used for portraiture may by a simple arrangement in its construction be employed with equally good results for views, without the dangerous plan usually adopted of turning the front Lens in its cell.

DOUBLE ACHROMATIC LENSES.

No. 1.	Quarter plate	1¾ diameter	2	0	0
— 2.	Half plate	2⅜ ,,	4	0	0
— 3.	Whole plate	3¼ ,,	10	0	0
— 4.	Pair of Corresponding Lenses with stops for the Bi-lens Camera		5	0	0

SINGLE ACHROMATIC LENSES, FOR VIEWS.

No. 1.	1½ inch diameter,	for views	5	by	4	1	5	0
— 2.	1¾ ,,	,,	6½	,,	5	1	10	0
— 3.	2½ ,,	,,	8½	,,	6½	3	10	0
— 4.	3½ ,,	,,	12	,,	10	6	0	0
— 5.	5 ,,	,,	18	,,	16	10	0	0

Stereoscopic View Lenses, £1.

Intermediate sizes made to order at proportionate prices.

The Landscape Lenses are supplied with rack and pinion, and the necessary Diaphragms.

LEREBOUR'S LENSES.

THE LONDON STEREOSCOPIC COMPANY supply the Lenses by Lerebour and Secretan, at manufacturers prices, the Company guarantee the genuineness of all Lenses supplied by them.

¼ plate for portraits	2	10	0
Do. for views	1	5	0
½ plate for portraits	4	0	0
Do. for views	1	12	0
Whole for portraits	10	0	0
Do. for views	4	0	0

VOIGTLANDER & SON'S

CELEBRATED DOUBLE ACHROMATIC LENSES.

¼ plate	6	6	0
½ do.	10	0	0
Whole	21	0	0

ROSS'S LENSES.

For portraits, from	5	5	0
For views "	4	0	0

EVERY DESCRIPTION OF

ENGLISH, FRENCH, AND GERMAN LENSES,

Of the ordinary sizes, kept in stock.

PHOTOGRAPHIC CHINA WARE.

NITRATE OF SILVER BATHS FOR COLLODION.

¼ Plate	3	0	Dipper.	0	9
⅓ ,,	3	6	,,	1	0
½ ,,	4	6	,,	1	6
1/1 ,,	5	6	,,	2	0
14½ by 10½	15	0	,,	3	0

PHOTOGRAPHIC DISHES.

	Shallow.		Deep.	
¼ Plate	1	0	1	6
½ ,,	1	6	2	6
1/1 ,,	2	0	3	6
12 by 9	3	0	4	6
14 by 10	5	6	8	0
11 by 14	9	0	14	0
23 by 19	25	0	33	0

Funnels, Filter stands, and every description of Photographic Porcelain Ware.

PHOTOGRAPHIC GLASS WARE.

Funnels	6d., 8d., 1s., 1s. 6d., 3s. and upwards.
Baths for Nitrate of Silver	1s. 6d. ,,
Dippers	4d., 6d. and 8d.

GLASS MEASURES.

1 Dram	0	9
1 Ounce	1	0
2 „	1	6
4 „	2	0
10 „	3	0
20 „	4	6

The above are warranted correctly graduated.

Glass Plates for Collodion or Albumen.

THE LONDON STEREOSCOPIC COMPANY supply a glass of very superior manufacture, which is far superior to the flatted crown, its colour, brilliancy and flatness is equal to Patent Plate.

2½ by 2	per dozen	0	5
3¼ „ 2¾	„	0	9
4¼ „ 3¼	„	1	3
5 „ 4	„	2	4
6½ „ 4¾	„	3	0
8½ „ 6½	„	4	6
Stereoscopic, 6¾ by 3¼	„	2	6

BEST PATENT PLATE.

4¼ by 3¼	per dozen	2	0
5 „ 4	„	3	0
6½ „ 4¾	„	4	6
8½ „ 6½	„	8	0
Stereoscopic	„	3	6

Stoppered Graduated Collodion Bottles, from 1 6

Precipitating, Test and other Glasses.

Glass Rods for stirring and spreading Solutions, Tubing, &c.

Spirit Lamps..............................1s. 9d., 2s. 6d., 3s. 6d.

GUTTA PERCHA.

BATHS.

¼ Plates	1	6
½ „	3	0
1/1 „	4	6
Stereoscopic	2	6

With water-tight top and cross clamps, ... from 4s. each.

FUNNELS, DISHES AND DIPPERS.

STILLS.

To obviate the difficulty so frequently occurring, viz. that of procuring pure distilled water, THE LONDON STEREOSCOPIC COMPANY, supply Stills of the simplest form which may be used over a common fire price, from 21s.

THE CHEMICAL DEPARTMENT

Is conducted under the personal superintendence of a practical Chemist, who, in the preparation and selection of the various chemicals, &c., adopts every means to insure their purity.

The London Stereoscopic Company's
IODIZED
NEGATIVE COLLODION,

Unsurpassed for uniformity of action, sensitiveness, and keeping qualities, giving great intensity in the lights, perfect half tones and detail in the shadows.

1-oz.	0	8
4 "	2	6
8 "	5	0
10 "	6	0
16 "	9	0
20 "	11	0

IODIZED POSITIVE COLLODION.

A most sensitive preparation, giving the most brilliant results.

1-oz.	0	6
8 "	3	6
10 "	4	0
16 "	7	6
20 "	9	0

These Collodions will keep for several months without undergoing any perceptible change; but, where it is desired, in quantities of not less than four ounces, the Iodizing Solution and Collodion may be had separate.

The above prices are exclusive of bottles.

NITRATE OF SILVER BATH,

Positive and Negative,

Carefully prepared and ready for immediate use. Price, 6d. per oz., or 9/. per pint (20-oz,).

CHLORIDE OF GOLD TONING BATH,

For giving fine tones to Prints, or Albumenized or Plain Paper. 3d. per box, or 4/. per pint (20-oz.)

DEVELOPING SOLUTIONS

FOR POSITIVES AND NEGATIVES.

FIXING SOLUTIONS

PREPARED TO ORDER.

IODIZING SOLUTION, AND ACETO-NITRATE OF SILVER SOLUTION FOR THE WAXED PAPER PROCESS,

PHOTOGRAPHIC PAPERS.

	PER QUIRE.	
Canson Fréres Negative, 23½ × 17½	2	6
Ditto ditto Positive, 23½ × 17½	3	6
Papier Saxe, Positive or Negative, 23 × 18	4	6
Ditto Salted	5	6
Papier Rives, Plain	3	6
Ditto ditto Salted	4	6
Waxed Paper		
Waxed and Iodized Paper		
Bibulous Paper		
Filtering ditto		

ALBUMENIZED PAPER.

No. 1, 23 × 18	10	0
2, superior, 23 × 18	12	0
3, extra albumenized, 23 × 18	15	0

The London Stereoscopic Company prepare an exceedingly highly Albumenized Paper, specially adapted for Stereoscopic Prints; which they supply at the following prices:—

Single Sheets, 17 × 11¼	0	0	8
Per Quire ,,	0	10	0
Per Ream ,,	9	9	0

YELLOW GLASS FOR DARK ROOMS.

YELLOW GLASS LANTERNS.

Horn Forceps for Removing Papers from Solutions.

PLATE HOLDERS.

SCALES AND WEIGHTS, WITH GLASS PANS, FROM 6s. PER BOX.

PESTLES AND MORTARS.

A CHOICE SELECTION OF MATS AND PRESERVERS, CASES AND PASSE PARTOUTS.

Nitrate	**Silver**	**Crystallised**	..	**3s. 9d. per Ounce.**
,,	,,	**Fused**	..	**4s. 3d.** ,,

DRY COLLODION.

Plates prepared by Dr. HILL NORRIS, ready for immediate use.

Stereoscopic, 6¾ × 3¼ . . . . 9s. per doz.

SOLUTIONS, &c., FOR ALL THE DRY PROCESSES.

CHEMICALS.

		s.	d.
Acid, Acetic, glacial	per ounce	0	6
Do. do. do. solid	„	1	0
Do. Gallic	„	1	6
Do. Pyrogallic	„	8	0
Do. Sulphuric, pure	„	0	3
Do. Nitric do.	„	0	2
Do. Hydrochloric	„	0	2
Do. Formic	„	0	6
Alcohol, 60 degrees, O.P.	„	0	4
Do. Absolute	„	0	8
Ammonia (Liquid)	„	0	4
Ammonium, Bromide	„	3	0
Do. Chloride	„	0	3
Do. Iodide	„	2	6
Barium. Chloride	„		
Do. Iodide	„	4	0
Baryta, Nitrate	„	0	3
Benzole, pure	„	0	6
Bromine, do.	„	2	0
Bromide of Cadmium	„	3	0
Do. Calcium	„	3	0
Do. Lime	„	1	0
Do. Potassium	„	2	0
Chloroform, pure	„	1	0
Do. Varnish	„	1	0
Charcoal, Animal, pure	„	0	6
Cotton Wool	„	0	6
Chloride of Gold	per drachm	9	0
Do. do.	15 gr. bulb	3	0
Do. Sodium, pure	per ounce	0	3
Distilled Water	per gallon	0	6
Ether, Rectified	per ounce	0	6
Do. Absolute	„	0	8
Do. Pyroligneous	„	0	2

		s.	d.
Gun Cotton	per ounce	2	6
Hyposulphite of Soda (very superior)	per pound	0	9
Iodine, pure resublimed	per ounce	1	6
Iodide of Calcium	,,	2	0
Iodide of Potassium	,,	2	0
Iron, Protosulphate	,,	0	2
Kaolin (China clay)	per pound	1	0
Mercury	,,	2	6
Naptha	per ounce	0	2
Potassium, Cyanide	4d. per ounce, or per pound	5	0
Rouge	per ounce	0	6
Sel D'Or	15 grain bottle	3	0
Tripoli	per ounce	0	6
Varnish Crystal	,,	0	6
,, Chloroform	,,	1	0
,, Benzoin	,,	1	0
,, Black	per bottle, 6d. &	1	0
Wax	per ounce	0	3

NOVELTY IN PHOTOGRAPHY!

JUST READY,

THE MINIATURE CAMERA.

The London Stereoscopic Company direct the attention
of Amateur and Professional Photographers,
to their

NEW POCKET STEREOSCOPIC CAMERA.

This little Apparatus with Focussing Glass, occupies a space of	4¼ in. by 5 by 4
With Lens and Dark Slide	8 by 4½ by 6
Ditto with 6 Dark Slides or 12 Groove Box and converging bars	15 by 4½ by 6

Is equally applicable to the Wet and Dry processes and will be found the most compact and complete piece of Apparatus yet contrived.

Camera, Dark Slide, Focussing Glass and parallel Bars		£2	2	0
Extra Dark Slides	each	0	10	0
The London Stereoscopic Company's Double Achromatic Lens with Stops		£2	5	0
Stereoscopic View Lens with Stop		1	5	0

LONDON STEREOSCOPIC COMPANY, 54, CHEAPSIDE, E.C.

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